

DRAFT

Kellogg WPCP
Odor Study Follow-up

Prepared for
Water Environment Services
February 18, 2014

DRAFT

Kellogg Water Pollution Control Plant
Odor Study Follow-up

Prepared for
Water Environment Services
February 18, 2014



6500 SW Macadam Avenue, Suite 200
Portland, OR 97239

Table of Contents

List of Figures.....	vi
List of Tables	vi
Executive Summary	vii
1. Background.....	1-1
1.1 Original Kellogg Creek WPCP Odor Studies	1-1
1.2 Existing Odor System.....	1-3
2. Alternatives Development.....	2-1
2.1 Alternatives under Evaluation	2-1
2.1.1 Alternative A – Sludge Loadout Interlock.....	2-1
2.1.2 Alternative B – Scum Pit Ventilation Improvements	2-3
2.1.3 Alternative C – Enclose Liquid Biosolids Loadout Facility	2-4
2.1.4 Alternative D – Biological Odor Control Scenarios	2-5
2.1.5 Alternative E – Cover Biofilters to Improve Dispersion	2-9
2.1.6 Alternative F – Dewater Biosolids and Reduce Trucking.....	2-9
3. Life-Cycle Cost Analysis.....	3-1
3.1 Methodology and Assumptions.....	3-1
4. Results	4-1
4.1 Capital Costs	4-1
4.2 Net Present Value	4-1
4.3 NPV of Engineered Media Versus Existing Media Systems	4-2
5. Next Steps.....	5-1
6. Limitations	6-1
Appendix A: Previous Odor Study Results.....	A-1
Appendix B: Alternatives Pre-Design Sketches	B-1
Appendix C: BC Cost Estimate.....	C-1
Appendix D: Life-Cycle Cost Analysis.....	D-1

List of Figures

Figure 1-1. Original Kellogg Creek WPCP odor study results	1-1
Figure 1-2. Dispersion modeling results.....	1-2
Figure 2-1. Flexible duct for removal of odorous air during biosolids truck loading.....	2-2
Figure 2-2. Alternative A site plan.....	2-2
Figure 2-3. Alternative B site plan.....	2-3
Figure 2-4. Alternative C site plan.....	2-4
Figure 2-5. Alternative D1 site plan	2-5
Figure 2-6. Alternative D1B site plan.....	2-6
Figure 2-7. Alternative D2 site plan	2-7
Figure 2-8. Alternative D3 site plan	2-8
Figure 2-9. Alternative E site plan.....	2-9
Figure 2-10. Alternative F site plan.....	2-10

List of Tables

Table ES-1. NPV of Each Alternative	vii
Table 2-1. Alternative A Costs and Strategy	2-2
Table 2-2. Alternative B Costs and Strategy.....	2-3
Table 2-3. Alternative C Costs and Strategy.....	2-4
Table 2-4. Alternative D1 Costs and Strategy	2-5
Table 2-5. Alternative D1B Costs and Strategy.....	2-6
Table 2-6. Alternative D2 Costs and Strategy	2-7
Table 2-7. Alternative D3 Costs and Strategy	2-8
Table 2-8. Alternative E Costs and Strategy.....	2-9
Table 2-9. Alternative F Costs and Strategy	2-10
Table 4-1. Capital Cost Comparison of Each Alternative.....	4-1
Table 4-2. NPV of Each Alternative	4-2
Table 4-3. Comparison of Existing and Engineered Media	4-2

Executive Summary

Based on results from a previous odor study, and in response to comments from the new Milwaukie Good Neighbor Committee, Water Environment Services (WES) commissioned a study to develop and prepare costs for odor reduction alternatives for the Kellogg Creek Water Pollution Control Plant (WPCP). WES and Brown and Caldwell staff discussed likely odor sources and developed treatment strategies in a workshop setting. The following is a summary of alternatives developed and considered during the evaluation:

- A. Sludge loadout interlock
- B. Scum pit ventilation improvements
- C. Enclose liquid biosolids loadout facility and add odor control equipment
- D. Biological odor control scenarios:
 - D1. Cover and treat aeration basins
 - D2. Cover and treat secondary clarifiers
 - D3. Cover and treat aeration basins and secondary clarifiers
- E. Cover existing biofilters and improve dispersion
- F. Dewater biosolids and reduce trucking

Each alternative underwent a conceptual design that was used to develop capital and operating costs. The capital and operating costs were then input into an economic model to conduct a Net Present Value (NPV) analysis based on a 20 year planning horizon.

Table ES-1. NPV of Each Alternative		
Alternative		NPV, \$
A	Sludge loadout interlock	10,000
B	Scum pit ventilation improvements	254,000
C	Enclose liquid biosolids loadout facility and add odor control equipment	1,892,000
D1	Cover and treat aeration basins	2,783,000
D2	Cover and treat secondary clarifiers	3,584,000
D3	Cover and treat aeration basins and secondary clarifiers	5,663,000
E	Cover biofilter and improve dispersion	1,982,000
F	Dewater biosolids and reduce trucking ^a	(3,925,000)

^aThe savings associated with changing from a liquid to a solids hauling program results in revenue for Kellogg.

The next step is to develop a methodology to evaluate, prioritize, identify, and budget for those alternatives that are to be carried forward for design and construction. Some options for deciding include the following:

- **Local Odor Panel.** Neighbors familiar with plant odors could tour the plant site and anecdotally identify areas of highest concern for them.
- **Odor Flux Evaluation.** An odor flux evaluation, as suggested by one of the Good Neighbor Committee members could be developed to quantify the odor reduction of each alternative.
- **Workshop Series.** A series of workshops could be facilitated during which a strategy to prioritize projects could be developed.
- **Odor Dispersion Modeling.** Each alternative could be evaluated using the previously created dispersion model. This strategy would require additional odorous air testing to be performed.

Section 1

Background

Water Environment Services (WES) strives to be a good neighbor at all of its facilities. In this regard, the Kellogg Creek WPCP has undertaken multiple odor evaluations. The results of these evaluations indicate that the Kellogg Creek WPCP is doing well when compared to industry standards for odor control at wastewater treatment plants. However, due to the proximity of the City of Milwaukie, even though industry standards are met, odors are sometimes detected outside the fence line. The following section describes the results of previous odor evaluations.

1.1 Original Kellogg Creek WPCP Odor Studies

To date, Brown and Caldwell (BC) and WES have conducted two extensive odor studies:

- Clackamas County Sanitary District (CCSD) Collection System and Kellogg WPCP Study (December 2010)
- Kellogg Creek WPCP Odor Study Project Follow-up Technical Memorandum (October 2011)

These two studies were used to identify potential odor sources within the CCSD collection system, the Kellogg Creek WPCP, and the Milwaukie Collection System. Figure 1-1 shows an aerial view of the Kellogg Creek WPCP superimposed with odor study results.

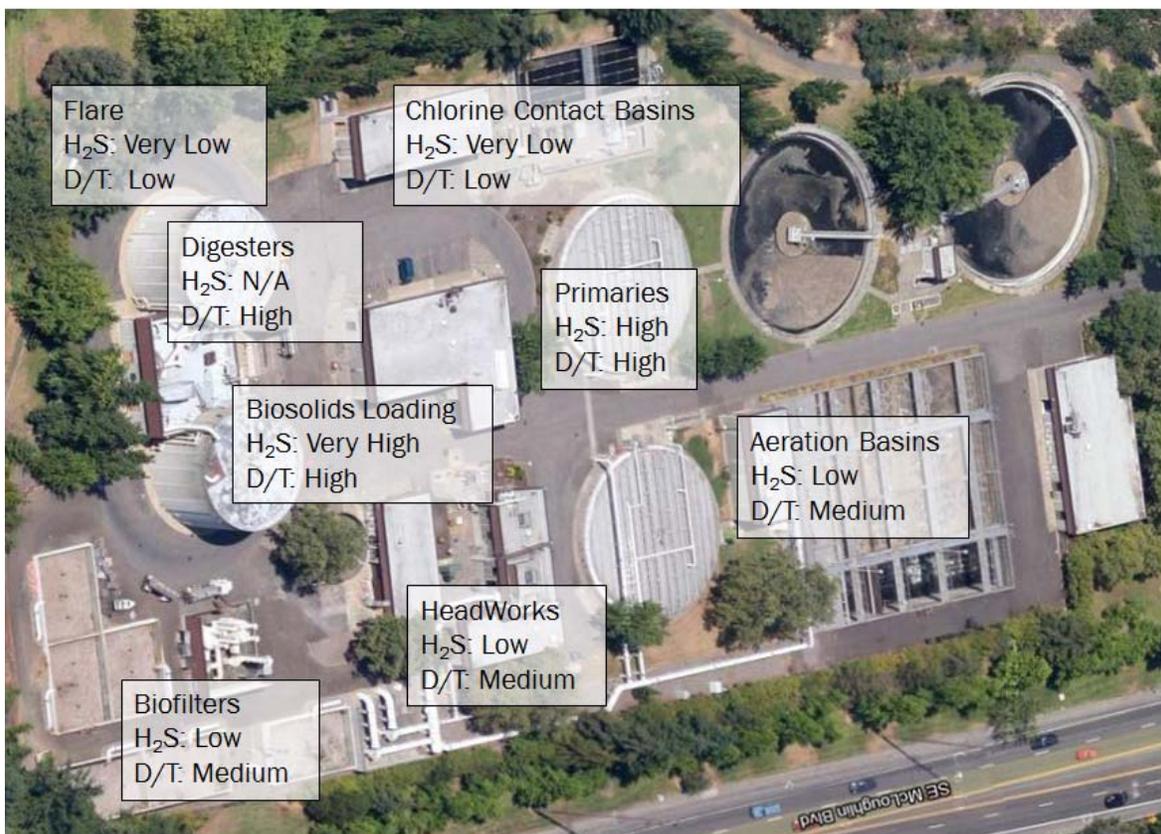


Figure 1-1. Original Kellogg Creek WPCP odor study results

Odors that would rarely escape treatment were detected at high levels in the areas of the liquid biosolids loadout, digester building roof, and the primary scum box. These odors were attributed to operational sources that generate odors intermittently during routine maintenance. Medium-strength odors detection occurred at the biofilters, headworks, and aeration basins. Even though the biofilters, headworks, and aeration basins were not found to have the strongest odors, their location next to the fence line required further consideration as potential odor sources.

To determine the potential for offsite odor impacts from the Kellogg Creek WPCP's emission sources, the sampling results were input into the U.S. Environmental Protection Agency's air dispersion model BEE-Line Software's Windows Interface (Version 9.83) (ISCST3). The dispersion model determines the total emission rate for the site and uses meteorological conditions, site characteristics, and the geometry of each emission source to determine how emissions from the plant disperse around the site. Three different operating scenarios were modeled to establish the offsite impacts of the emissions sources under various operating conditions. The scenarios varied based on plant hydraulic capacity and operation and maintenance activity at the plant to model worst-case and normal operating conditions. The results of the dispersion modeling runs were provided as contour plots, with each contour representing a predicted odor concentration. Dispersion model results are shown in Figure 1-2. The 20 dilution to threshold (D/T) contour represents the area at which odors typically become difficult to detect with 10 D/T being virtually undetectable.



Figure 1-2. Dispersion modeling results

Modeling showed that emissions from the operational sources would be detected rarely; however sampling confirmed that when detected they were the type of odors that would be likely to generate complaints. It is BC's understanding that some of the operational challenges presented in the previous odor studies listed above have been acted upon already by WES.

Additional, anecdotal evidence from plant operators and neighbors concluded that the following sources were the most likely contributors to offsite odors:

- aeration basins
- secondary clarifiers
- biofilters (especially during media replacement every 5 years)

Results including odor compounds and concentrations from the original reports can be found in Appendix A.

There are many potential odor sources. WES staff have found it difficult to investigate the exact source(s) contributing to offsite odor complaints due to the lack of local weather station data. Therefore, they recently installed a weather station at the plant to better track weather conditions, such as wind direction.

1.2 Existing Odor System

The biofilter system currently in use consists of six individual cells. Each cell treats approximately 3,667 cubic feet per minute of foul air. The existing in-ground biofiltration system treats foul air continuously from the following plant facilities:

- influent sewer junction box
- influent pump station wet well
- headworks building
- solids handling building
- sludge storage tank
- primary clarifiers
- primary scum pits
- primary sludge pump station.

Typically, biofilters can provide up to 99 percent removal of total reduced sulfide compounds in a foul air stream and greater than 90 percent removal of total odors with a 60-second empty bed contact time through the cells. Each biofilter cell at the Kellogg Creek WPCP provides a 105-second empty bed contact time. Due to extended residence time in the biofilters, it is unlikely that any residual total sulfur compounds would be detectable offsite; however, because the biofiltration system is in close proximity to the fence line and has a large total surface area (approximately 11,000 square feet), it was identified as a possible odor source.

Section 2

Alternatives Development

To prepare for the initial workshop, Brown and Caldwell staff reviewed odor sources documented in the previous studies and identified common odor treatment strategies that would be presented to the WES review team. The team assembled for the workshop included WES staff from the Kellogg and Tri-City facilities and an additional outside wastewater engineering consultant that was already familiar with the Kellogg Facility. During the workshop, other potential odor sources that might be noticed off site were discussed along with potential treatment alternatives. The following alternatives were identified for further evaluation:

- A. Sludge loadout interlock—interlocking the odor control fan with the sludge loading pump
- B. Scum box ventilation improvements
- C. Enclose liquid biosolids loadout facility and add odor control equipment
- D. Biological odor control scenarios:
 - D1. Cover and treat aeration basins
 - D2. Cover and treat secondary clarifiers
 - D3. Cover and treat aeration basins and secondary clarifiers
- E. Cover biofilters and add stacks to improve dispersion
- F. Dewater biosolids and reduce trucking

WES staff provided operational data to allow each alternative to be fully developed.

2.1 Alternatives under Evaluation

The alternatives considered for evaluation are discussed below. Each alternative underwent conceptual design to be able to reflect the costs of implementation accurately. Hand sketches created for each alternative are included in Appendix B. WES staff provided operational data for each of the existing processes investigated. BC staff worked with vendors and our internal cost estimating group to characterize capital and operating costs for all the alternatives. The concepts are discussed below. The color blue on the figures indicates improvements required to bring about each alternative.

2.1.1 Alternative A – Sludge Loadout Interlock

The liquid biosolids loadout facility utilizes a flexible odor control duct that is connected to an existing exhaust fan for removal of odorous air associated with the biosolids loadout process, as shown in Figure 2-1. The flexible odor duct is small so that it can be placed inside the truck hatch to capture any odors associated with truck loading.

Trucks can be loaded with primary sludge, secondary sludge, or digested biosolids at the loadout facility. To ensure that the fan is pulling odorous air every time a truck is loaded, it is recommended that the sludge pumps be interlocked with the exhaust fan. To accomplish this task, minor hardware and software modifications to the programmable logic controller and motor control center would be required for this upgrade.



Figure 2-1. Flexible duct for removal of odorous air during biosolids truck loading

Figure 2-2 shows the site plan for Alternative A. Table 2-1 lists the capital cost and odor control strategy for this alternative.

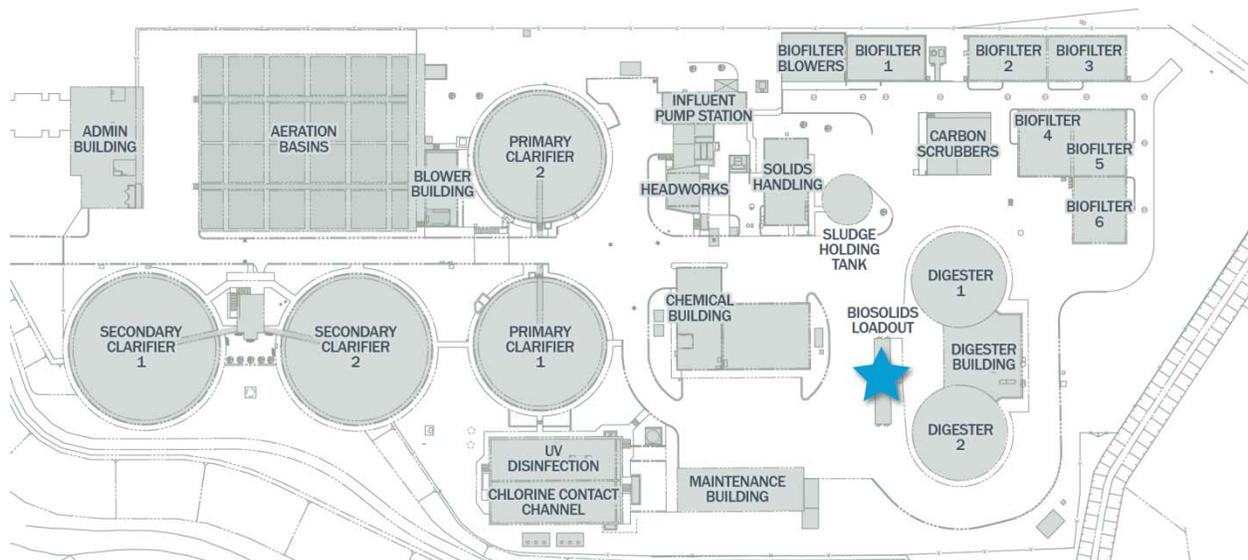


Figure 2-2. Alternative A site plan

Table 2-1. Alternative A Costs and Strategy	
Capital costs	Odor control strategy
\$10,000	No additional odor treatment capacity is required.

2.1.2 Alternative B – Scum Pit Ventilation Improvements

The scum pit boxes located on the primary clarifiers are a potential source of odor when they are opened for regular cleaning. Cleaning is performed once per week and lasts approximately 10 minutes. In Alternative B, new ducting would be installed to connect the scum boxes to the existing odor control system. Air flow would increase by approximately 820 cubic feet per minute (cfm) per scum pit. Capital costs include all ducts and fittings required to connect to the existing system. The presence of existing buried utilities prevents the ducts from being buried. Capital costs for this alternative also include installation of supports to route the duct up and over the road and to a connection point with the existing ductwork.

Figure 2-3 shows the site plan for Alternative B. Table 2-2 lists the capital cost and odor control strategy for this alternative.

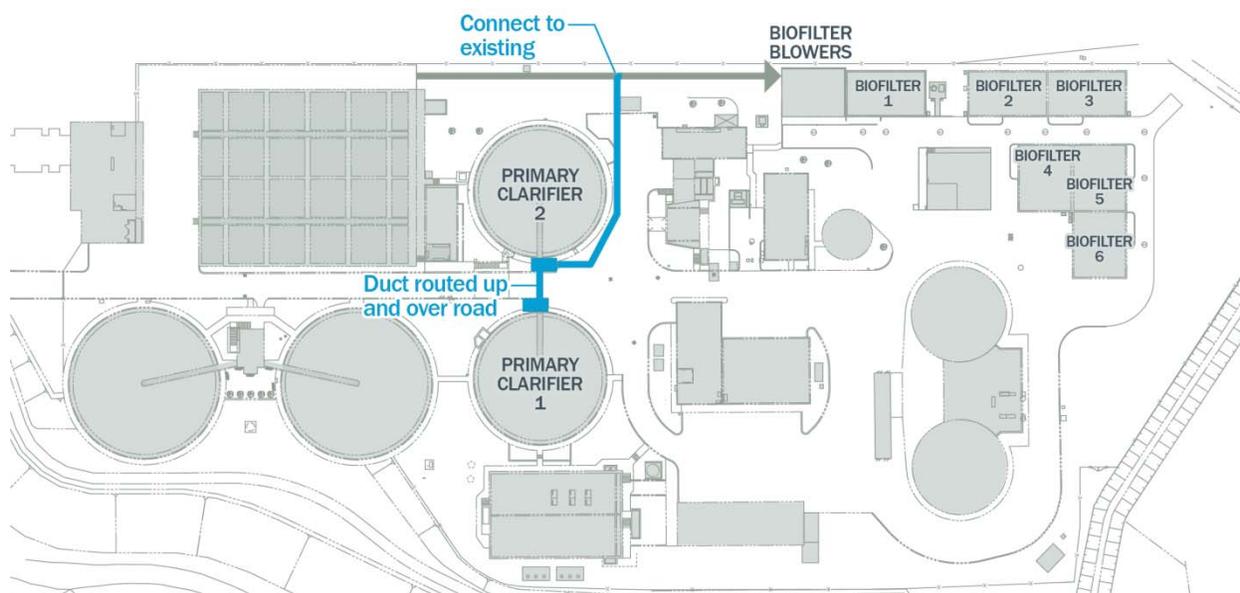


Figure 2-3. Alternative B site plan

Table 2-2. Alternative B Costs and Strategy	
Capital cost, \$	Odor control strategy
242,000	New air flow directed to existing system, no additional capacity required.

2.1.3 Alternative C – Enclose Liquid Biosolids Loadout Facility

In this alternative, the liquid biosolids loadout facility would be enclosed by a concrete building with rollup doors to allow the truck to pass through the building. One new fan would be required to convey odorous air to a new package biofiltration tower located adjacent to the new building. The alternative currently includes traditional, metal rollup doors. However, a new fabric door technology has been developed that opens rapidly in under 2 seconds, minimizing the time during which odors could escape.

Figure 2-4 shows the site plan for Alternative C. Table 2-3 lists the capital cost and odor control strategy for this alternative.

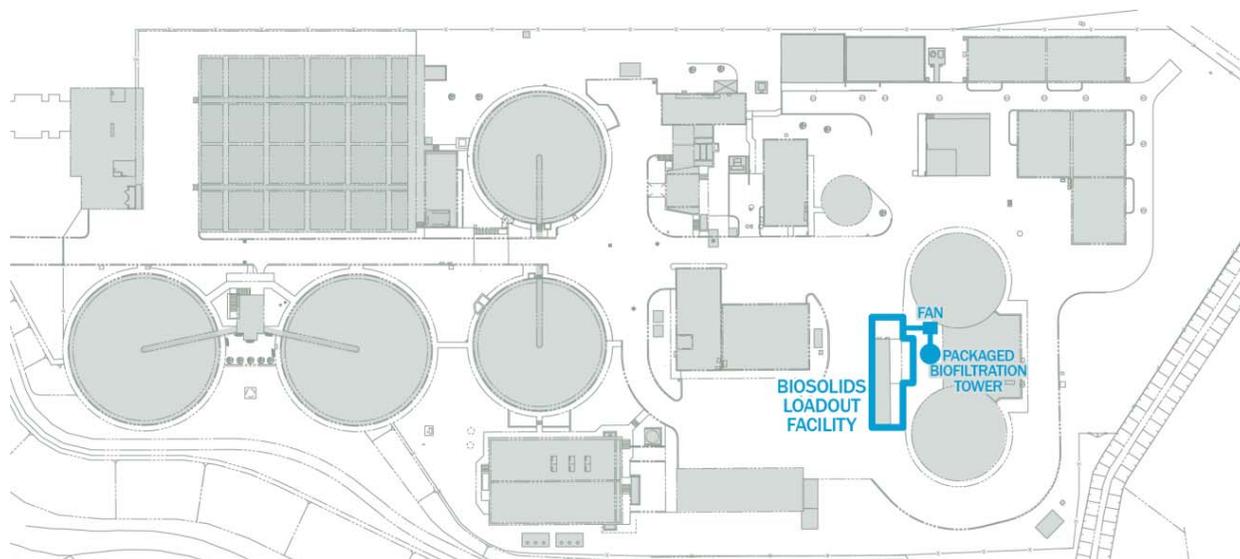


Figure 2-4. Alternative C site plan

Table 2-3. Alternative C Costs and Strategy	
Capital cost, \$	Odor control strategy
1,430,000	Enclose building and treat air via a packaged biofiltration tower

2.1.4 Alternative D – Biological Odor Control Scenarios

Alternative D was subdivided into three comparable scenarios and a fourth to allow for comparison of a different engineered media for one scenario. All of these scenarios would require covering the listed process units to trap any odorous air as well as replacing media (types include composted wood chip, ground wood or engineered media) to accommodate the increase in air that requires treatment.

Alternative D1 – Cover and Treat Aeration Basins

In alternative D1, the aeration basins would be covered with 13,500 square feet (SF) of extruded aluminum material. Odorous air collected from the covered basins would be conveyed via new ducting to connect into the existing duct system. The existing biofiltration system was originally designed to accommodate air from aeration basins that were entirely covered. Therefore, one new blower and additional organic biofilter media are believed to be the only capital costs required to treat the additional 15,000 cfm of air to currently achieved levels. The design capacity of the existing system would be confirmed during any detailed design project to add additional aeration basin covering.

Figure 2-5 shows the site plan for Alternative D1. Table 2-4 lists the capital cost and odor control strategy for this alternative.

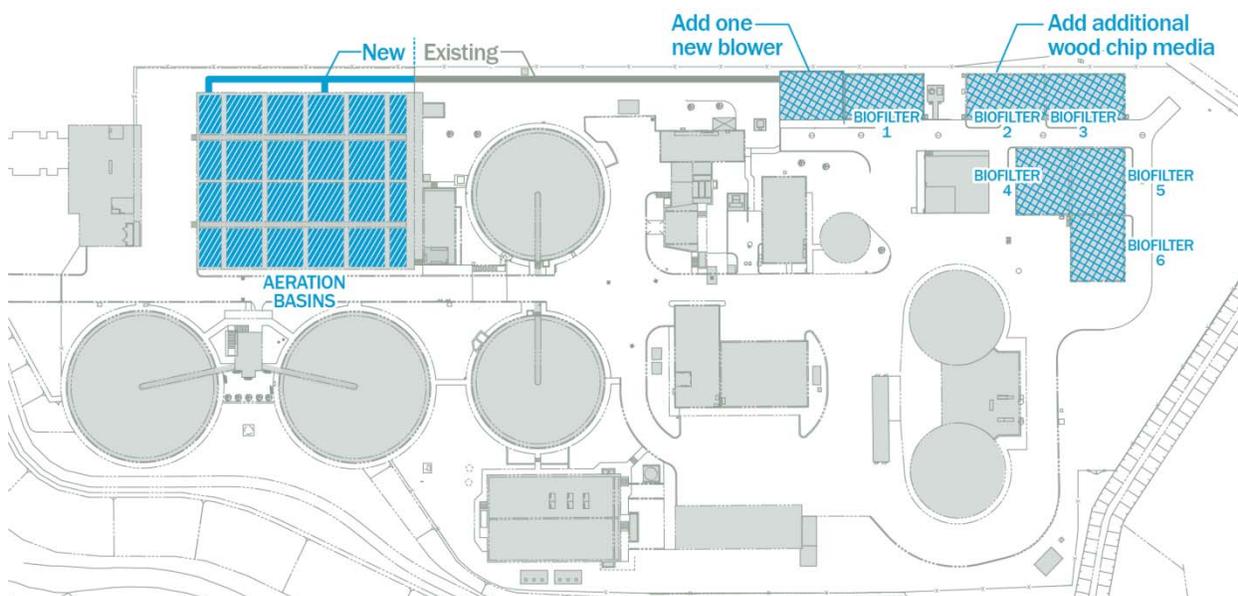


Figure 2-5. Alternative D1 site plan

Table 2-4. Alternative D1 Costs and Strategy	
Capital cost, \$	Odor control strategy
2,200,000	Cover the aeration basins and increase capacity by adding organic media to existing odor treatment system.

Alternative D1B – Cover and Treat Aeration Basins with Engineered Media

During the evaluation process, an additional alternative was developed to consider replacing the existing biofilter media with engineered media. Even though the capital cost for the engineered media is more expensive than the currently used organic media, engineered media has a longer useful life of 15 years and requires much less surface area for treatment. The existing organic media is typically replaced every 5 years. To determine the benefits of changing media types, a sub-alternative was developed with similar costs that is comparable to Alternative D1. In this sub-alternative, the cost for covering the aeration basins, all ducting supports and appurtenances, a new blower and new engineered media are included.

Figure 2-6 shows the site plan for Alternative D1B. Table 2-5 lists the capital cost and odor control strategy for this alternative.

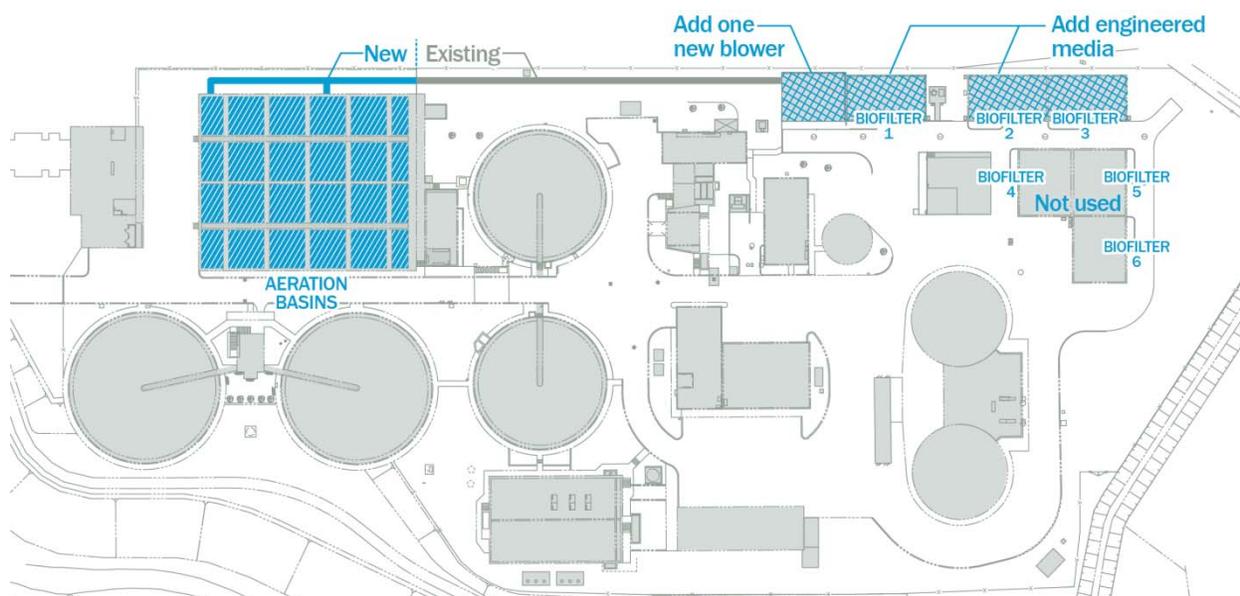


Figure 2-6. Alternative D1B site plan

Table 2-5. Alternative D1B Costs and Strategy	
Capital cost, \$	Odor control strategy
2,500,000	Cover the aeration basins and increase capacity by replacing the existing odor treatment system with engineered media.

Alternative D2 – Cover and Treat Secondary Clarifiers

In this alternative, the secondary clarifiers would be covered with 16,000 SF of extruded aluminum material. Odorous air, approximately 20,000 cfm collected from the covered clarifiers would be conveyed via new ducting and a new fan to one packaged biofiltration tower. The capital cost includes the covers, all ducting, supports and appurtenances, and the odor system.

Figure 2-7 shows the site plan for Alternative D2. Table 2-6 lists the capital cost and odor control strategy for this alternative.

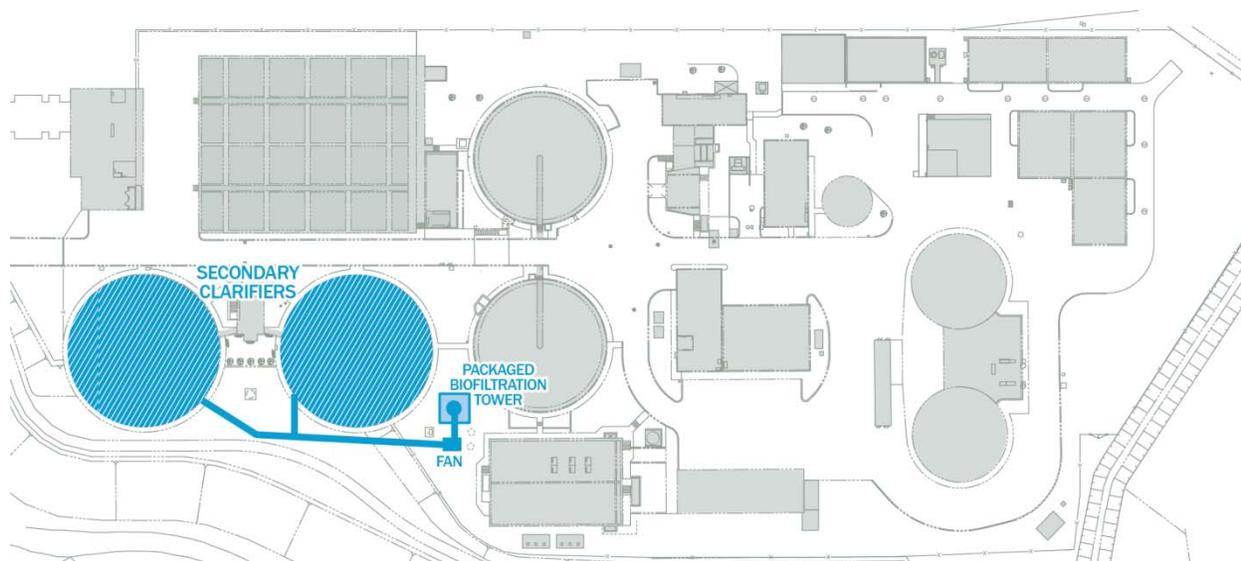


Figure 2-7. Alternative D2 site plan

Table 2-6. Alternative D2 Costs and Strategy	
Capital cost, \$	Odor control strategy
3,400,000	Cover secondary clarifiers and treat air via a packaged biofiltration tower

Alternative D3 – Cover and Treat Aeration Basins and Secondary Clarifiers

In this alternative, both the aeration basins and secondary clarifiers would be covered. Air is conveyed via new ducting with two new fans to two package biofiltration towers. The capital cost includes the aluminum covers, all ducting, supports, and appurtenances for conveying the air and the two odor control towers.

Figure 2-8 shows the site plan for Alternative D3. Table 2-7 lists the capital cost and odor control strategy for this alternative.

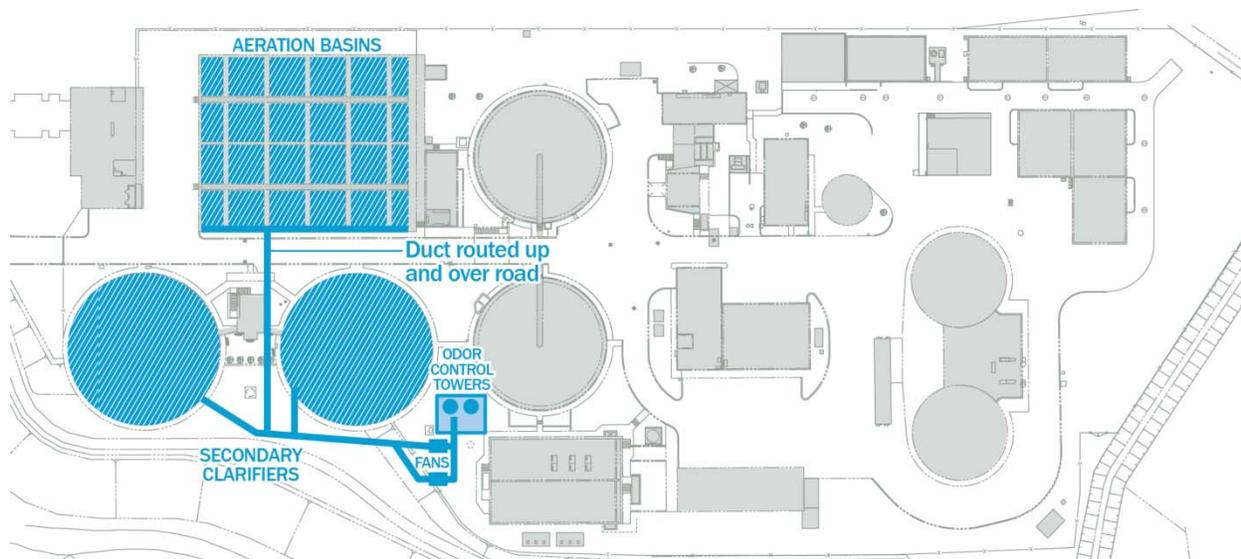


Figure 2-8. Alternative D3 site plan

Table 2-7. Alternative D3 Costs and Strategy	
Capital cost, \$	Odor control strategy
5,400,000	New fan and two package biofiltration towers

2.1.5 Alternative E – Cover Biofilters to Improve Dispersion

The biofilter media emits a musty earthy smell that potentially could be detected across the fence line. To prevent the dispersion of odorous air, an engineered fabric cover and fiberglass stack would be installed in the existing biofilter media beds. The stack would release the treated air for dispersion at a higher elevation which would reduce the potential for detection near the fence line.

Figure 2-9 shows the site plan for Alternative E. Table 2-8 lists the capital cost and odor control strategy for this alternative.

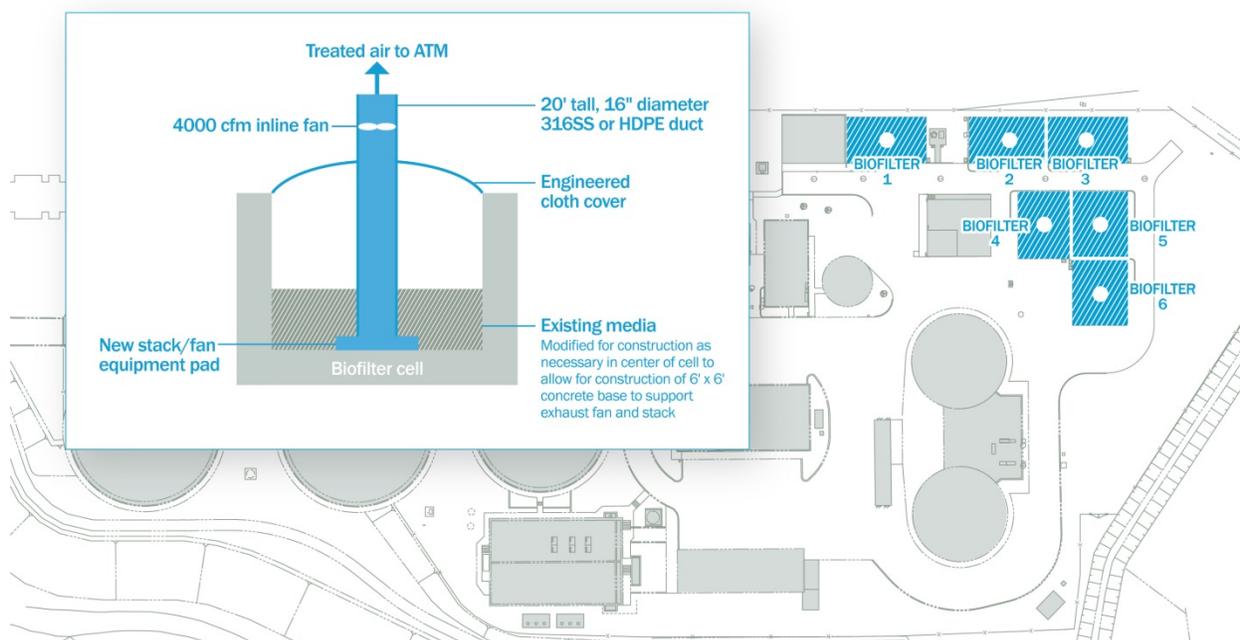


Figure 2-9. Alternative E site plan

Table 2-8. Alternative E Costs and Strategy	
Capital cost, \$	Odor control strategy
1,900,000	Cover biofilters with an engineered cover.

2.1.6 Alternative F – Dewater Biosolids and Reduce Trucking

Currently, biosolids produced at Kellogg WPCP are hauled offsite as a liquid product, requiring loading of trucks multiple times a day. The odors released in the area of the existing sludge loadout facility were some of the strongest detected. Additionally, the liquid program requires that trucks be loaded approximately eight times per day depending on plant operating conditions. Migrating to an enclosed dewatering strategy would reduce both the potential for odor release and the number of loadings per day. This alternative has the added advantage of significantly reducing the amount of truck traffic associated with the solids program.

In Alternative F, a biosolids dewatering facility would be constructed and the liquid product would be dewatered via a centrifuge. The capital cost for this alternative includes a new two-story building adjacent to the existing digester complex that would house the dewatering equipment as well as the truck loadout. A new asphalt driveway would need to be installed to allow truck access. The odorous air pulled off the building would be treated via a single packaged biofiltration system located in the old sludge loadout area.

Figure 2-10 shows the site plan for Alternative F. Table 2-9 lists the capital cost and odor control strategy for this alternative.

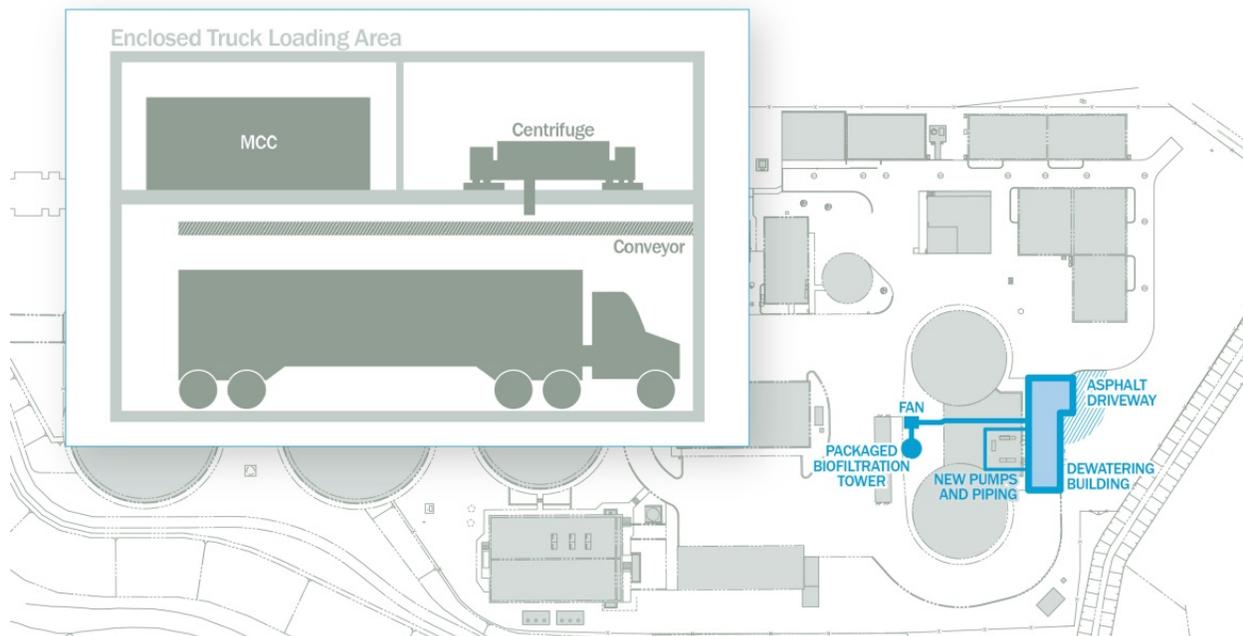


Figure 2-10. Alternative F site plan

Table 2-9. Alternative F Costs and Strategy	
Capital cost, \$	Odor control strategy
4,300,000	Enclose building and treat air via a packaged biofiltration

Section 3

Life-Cycle Cost Analysis

An economic model was developed that considered a 20-year planning horizon. The model was used to compare the program cost for WES to install and operate each of the odor mitigation alternatives. Results of the cost model are presented in total program costs discounted to 2014 dollars as a net present value (NPV).

NPV analyses are a standard method for using the time value of money to appraise and compare the economics of competing alternatives with varied one-time and annual costs. The present value of the costs for each individual year was totaled and then discounted to 2014 dollars. The total costs for the 20-year planning period were used to calculate the NPV.

3.1 Methodology and Assumptions

The following data were provided by WES staff. These assumptions were common to all the alternatives:

- inflation rate of 4 percent
- interest rate of 2 percent
- labor rate of \$46.94 per hour with an annual increase in salary of 4 percent
- electricity costs of \$0.07 per kilowatt hour
- water costs of \$0.0046 per gallon

Other alternative-specific assumptions were obtained from WES staff and through discussions with vendors:

- Packaged biofilter tower media replacement of \$61,000 every 15 years
- Existing wood chip biofilter media replacement of \$83 per cubic yard every 5 years
- Variable replacement costs were provided for mechanical equipment including blowers, centrifuge, and odor towers
- Savings due to reduced hauling for Alternative F of \$511,000 per year

The capital costs for construction and installation of each alternative were compiled by the BC cost estimating group. The estimate included 35 percent for contingency in addition to costs for items such as contractor general conditions, startup, training, O&M, building risk, and liability. The cost estimate is included in Appendix C. An economic model was used to forecast the cost of operating each alternative over a 20-year planning period. The life-cycle cost analysis for each alternative is included in Appendix D.

Section 4

Results

Results of the cost model are presented here for each alternative.

4.1 Capital Costs

The capital costs for each alternative are outlined in Table 4-1.

Table 4-1. Capital Cost Comparison of Each Alternative		
Alternative		Capitol cost, \$
A	Sludge load out interlock	10,000
B	Scum pit ventilation improvements	242,000
C	Enclose liquid biosolids load out facility and add odor control equipment	1,430,000
D1	Cover and treat aeration basins	2,200,000
D2	Cover and treat secondary clarifiers	3,400,000
D3	Cover and treat aeration basins and secondary clarifiers	5,400,000
E	Cover biofilter and improve dispersion	1,900,000
F	Dewater biosolids and reduce trucking	4,300,000

As expected, the capital costs were highest for the alternatives that required the most construction. For example, the cost to cover the aeration basins and secondary clarifiers resulted in the highest capital costs. This alternative required a significant amount of aluminum planking, new ductwork, and two odor control towers. Alternatives A and B cost the least and included a minimal amount of electrical work and new ducting, respectively.

4.2 Net Present Value

The cumulative costs illustrated via an NPV for each odor mitigation alternative are listed in Table 4-2. It is important to consider the operational costs or savings of each alternative over time to give an accurate picture of the overall cost of each alternative.

Table 4-2. NPV of Each Alternative		
Alternative		NPV, \$
A	Sludge load out interlock ^a	10,000
B	Scum pit ventilation improvements	254,000
C	Enclose liquid biosolids load out facility and add odor control equipment	1,892,000
D1	Cover and treat aeration basins	2,783,000
D2	Cover and treat secondary clarifiers	3,584,000
D3	Cover and treat aeration basins and secondary clarifiers	5,663,000
E	Cover biofilter and improve dispersion	1,982,000
F	Dewater biosolids and reduce trucking ^b	(3,925,000)

^aSludge load out interlock is a one time cost and once installed does not require any maintenance or replacement over the 20-year period.

^bThe savings associated with changing from a liquid to a solids hauling program results in revenue for Kellogg.

The operation and maintenance costs for Alternatives C through E added close to \$200,000 to the capital costs over the 20-year period. Alternatives A and B do not require much maintenance and therefore exhibited little change from the capital costs. Alternative F resulted in an overall savings for the Kellogg facility. These savings are associated with changing from a liquid hauling program to a dewatered cake program.

4.3 NPV of Engineered Media Versus Existing Media Systems

A second analysis was conducted to determine the cost benefits of switching from the biofilter wood chip media to an engineered media. The biofilter wood chips have a lower capital cost of approximately \$57 per cubic yard installed but require replacement every 5 years. Typical life expectancy in the industry for the biofilter wood chips is 3 to 5 years. WES staff has successfully managed the wood chips and observed longer life times approaching 7 years. However, as the media approaches the end of its useful life, the possibility of short circuiting in the media bed increases, which could result in detectable odors beyond the fence line. For these reasons, a life expectancy of 5 years was assumed.

The engineered media are much more expensive at approximately \$400 per cubic yard installed but are replaced every 15 years. To compare the costs of these two alternatives accurately, the NPV analysis was conducted over a 14-year interval. In a 20-year NPV, the engineered media would be replaced twice and the benefits of the last 10 years of useful life would remain unaccounted for. The NPV results are shown in Table 4-3.

Table 4-3. Comparison of Existing and Engineered Media		
Alternative		NPV, \$
D1	Cover and treat aeration basins - odor treatment with existing wood chip/ground wood media	938,000
D1B	Cover and treat aeration basins - odor treatment with engineered media	750,000

Even though the up-front capital costs of engineered media are higher than those for wood chip media, the longer time interval before replacement results in a lower NPV. The engineered media also can treat the same amount of odorous air in three of the biofiltration basins, allowing the other three bays to be converted for other plant use. The benefits provided from the additional plant space were not quantified in this analysis.

Section 5

Next Steps

The intent of this study was to identify likely odor sources and develop strategies and costs to address them. The logical next step is to develop a methodology to evaluate, prioritize, identify, and budget for projects that are to be carried forward for construction. A range of potential qualitative and quantitative methodologies could be employed for this process. A few potential concepts are described below in order of increasing effort:

- **Local Odor Panel.** A panel comprised of neighbors familiar with plant odors could be assembled to tour the plant site and anecdotally identify those odors that are of concern and that are detected outside the fence line. The panel could then suggest which areas are of highest concern.
- **Odor Flux Evaluation.** An odor flux evaluation, as suggested by one of the Good Neighbor Committee members could be developed and considered as part of the process. The evaluation could use volumes of odorous air produced as part of the formula. This is not an uncommon strategy.
- **Workshop Series.** A series of workshops could be facilitated during which a strategy to prioritize projects could be developed. Items such as cost, potential for odor reduction, and life cycle could be discussed and considered during the process.
- **Odor Dispersion Modeling.** Each alternative could be evaluated using the previously-created dispersion model. The model would be adjusted and re-run for the specific condition for each alternative. This strategy would require additional odorous air testing to be performed.

Section 6

Limitations

This document was prepared solely for Water Environment Services in accordance with professional standards at the time the services were performed and in accordance with the contract between WES and Brown and Caldwell dated September 8, 2011. This document is governed by the specific scope of work authorized by WES; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by WES and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Appendix A: Previous Odor Study Results

Table 2. Odor Sampling Results for KCWPCC Processes

Emission source	2011 sampling results				2010 sampling results			
	TGNMO (as hexane), ppbV	Testing results			TGNMO (as hexane), ppbV	Testing results		
		H ₂ S, ppbV	D/T	TRS, ppbV		H ₂ S, ppbV	D/T	TRS, ppbV
Aeration basin – anoxic selector	460	8.8	220	ND	390	56	990	MM = 5.7
Primary scum box	350	9.6	220	ND	400	5,200	4,600	COS = 8.2 MM = 190 DMS = 17
Digester #1 supply water pressure vacuum breaker valve	400	9.2	330	ND	NSC	NSC	2,300	NSC
Biofilter#1, sample #1 ¹	880	5.8	260	ND	1,000	7.4	280	ND
Biofilter#1, sample #2 ¹	720	NSC	120	NSC	NSC	NSC	NSC	NSC
Biosolids loading tank ²	870	22,000	>60,000	MM = 17 EM = 5.6 CDS = 4.6 PM = 7.3	ND	170,000	5,200	MM = 17 EM = 14 CDS = 8.5 PM = 23

¹ Samples from 2010 and 2011 were all taken from the media surface at Biofilter #1.

Acronyms:

- CDS = carbon disulfide
- COS = carbonyl sulfide
- DMS = dimethyl sulfide
- DMDS = dimethyl disulfide
- EM = ethyl mercaptan
- MM = methyl mercaptan
- ND = non-detect: (less than minimum reporting limit)
- NSC = no sample collected
- PM = n-propyl mercaptan
- ppbV = parts per billion by volume

Appendix B: Alternatives Pre-Design Sketches

Alternative B. Scum Pit Ventilation Improvements

Convey foul air from the primary clarifier scum boxes via a 16 inch diameter duct and connect to existing duct system. Duct system will be installed above grade with the 10" duct from Primary Clarifier #1 scum box going up and over the road minimum clearance must be at least 20'.

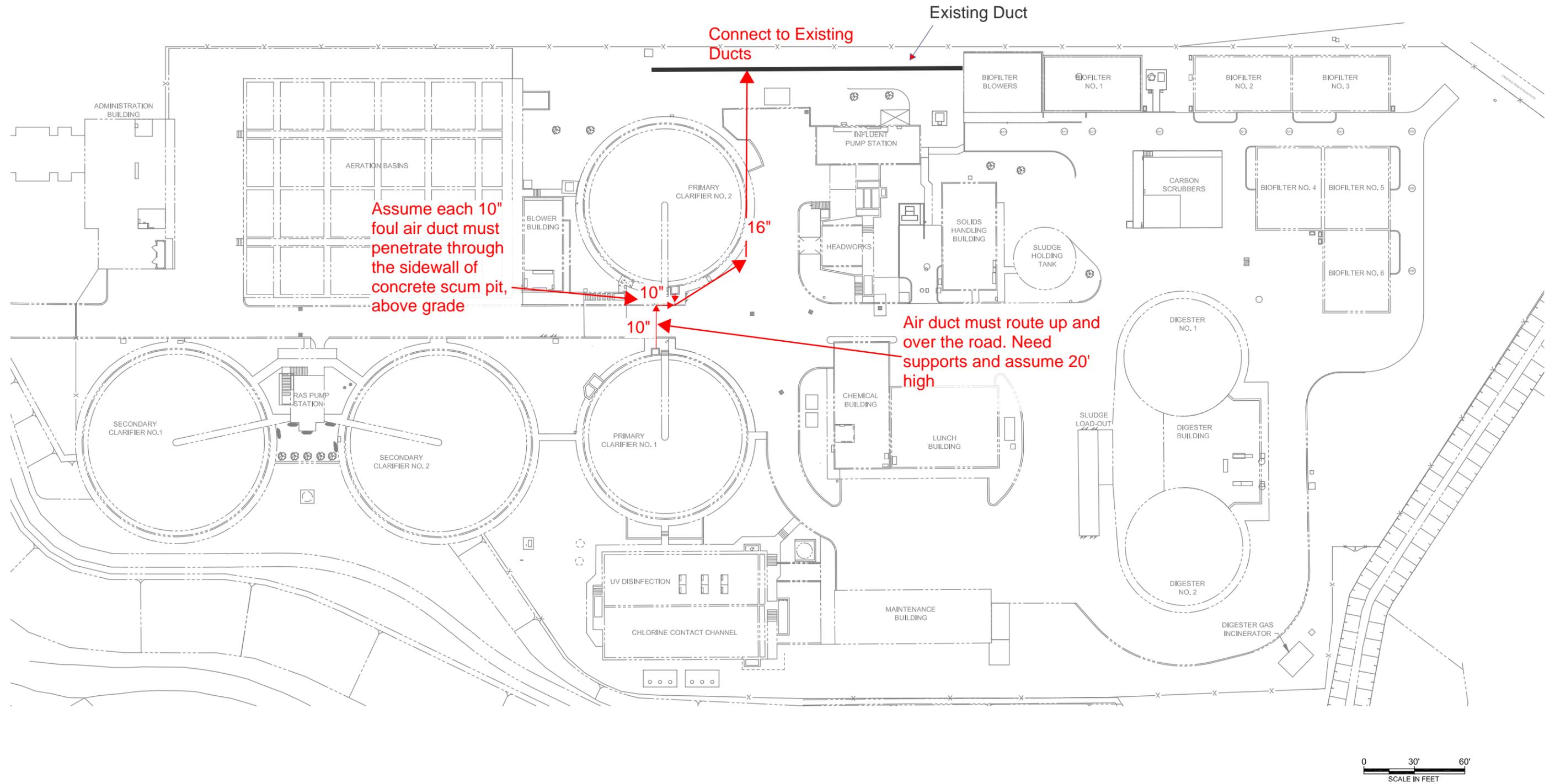


FIGURE 1
SITE PLAN AND VICINITY MAP

Alternative C. Enclose Biosolids Loadout Facility

Construct a building over the existing solids loadout facility location with 2 roll-up doors. The assumed one story building dimensions should be 85' L x 22' W x 20' H. Convey foul air adjacent the building via a 32" duct to a 11k cfm odor treatment system adjacent to the new building.

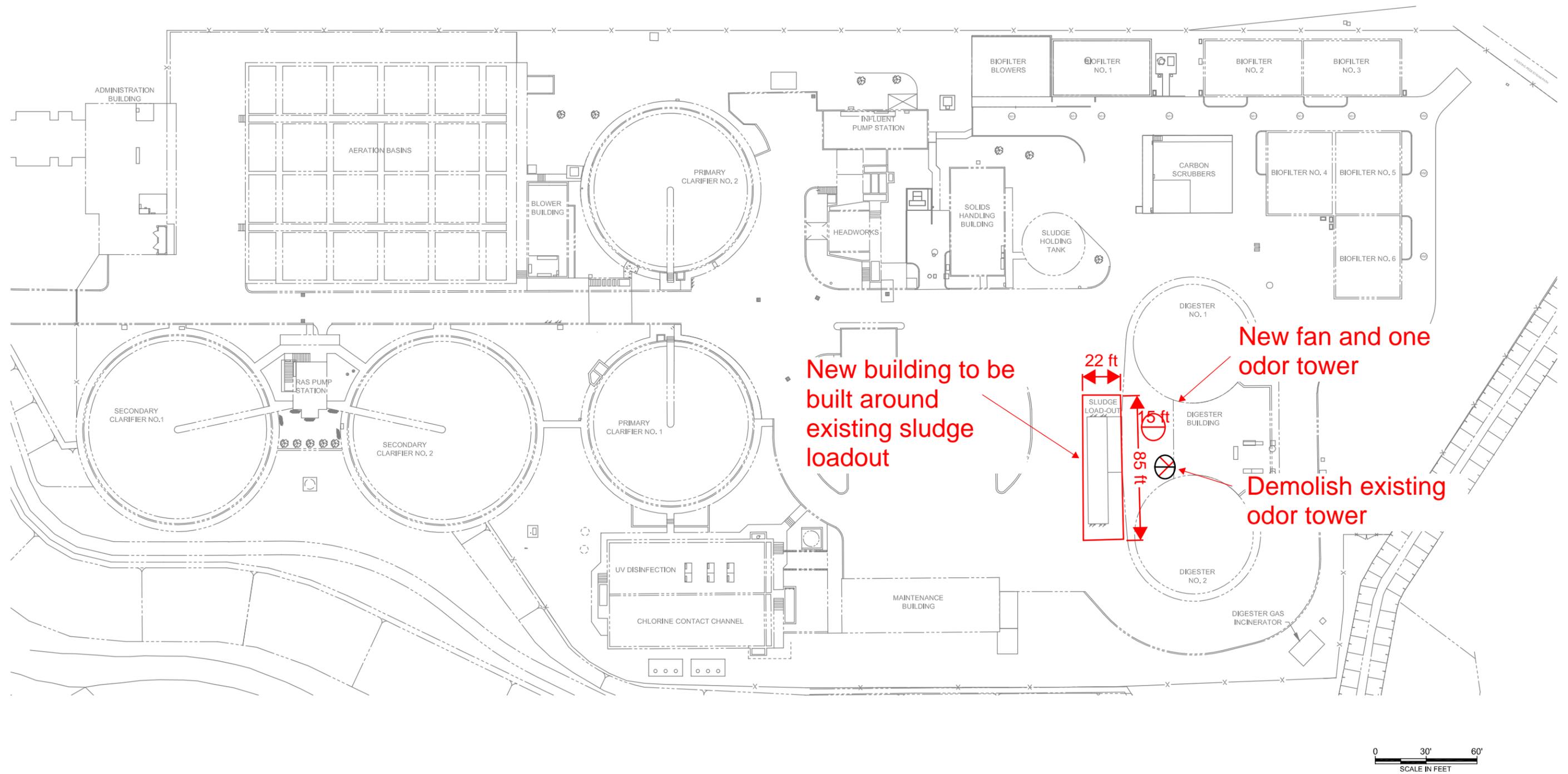
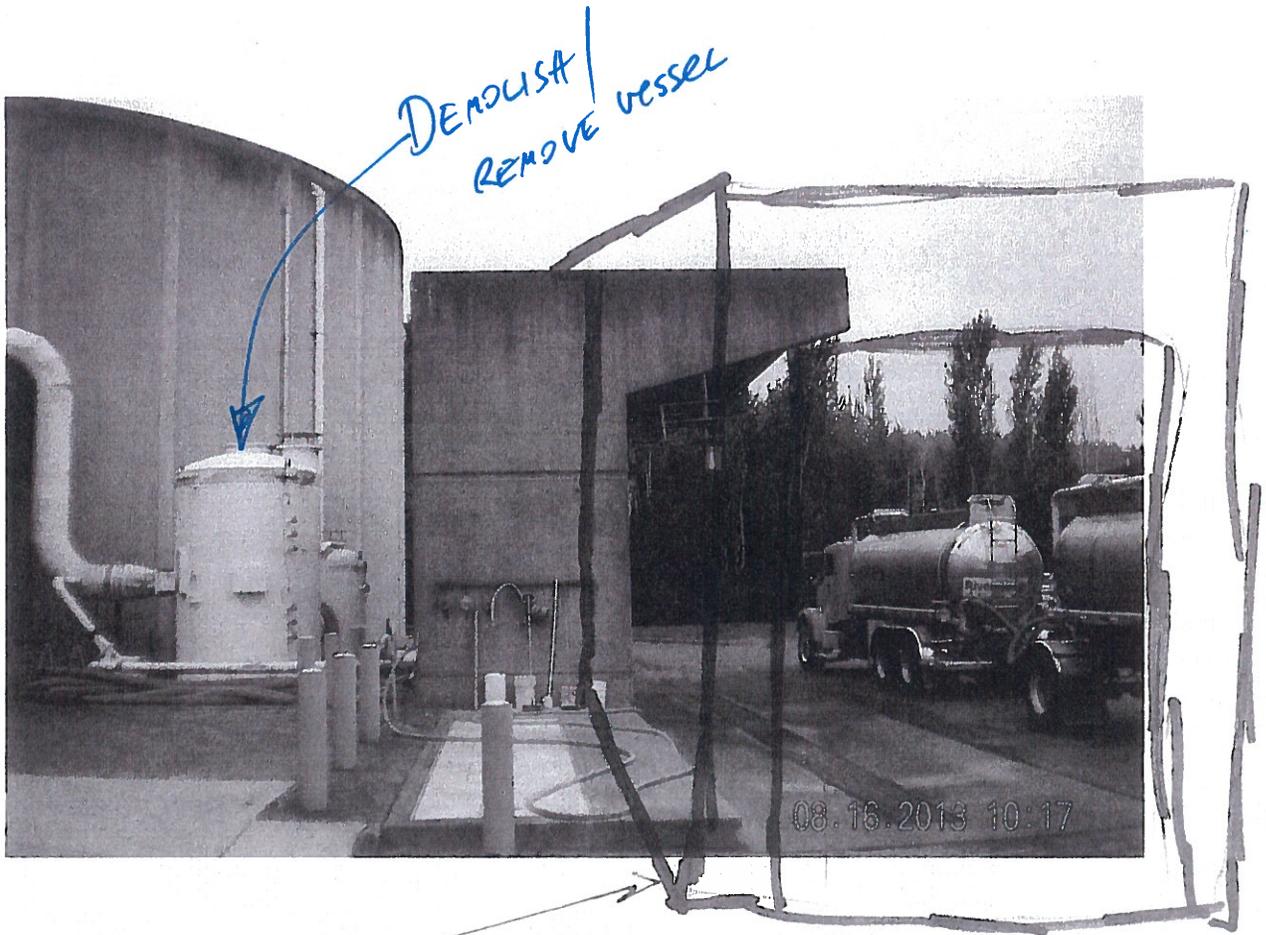


FIGURE 1
SITE PLAN AND VICINITY MAP



BUILDING TO ENCLOSE TRUCK AND PORTION OF
EXISTING LOADING STRUCTURE TO REDUCE
ODOROUS AIR EMISSIONS.

ALT. C

Alternative D1. Biological Odor Control - Cover and Treat Aeration Basins (15k cfm system)

Foul air is conveyed from the aeration basins via a 36" diameter existing duct above grade to the existing odor system. Biofilters will be upgraded through the addition of a total of 550 cubic yards of composted wood chip biofilter media to the 6 biofilter cells.

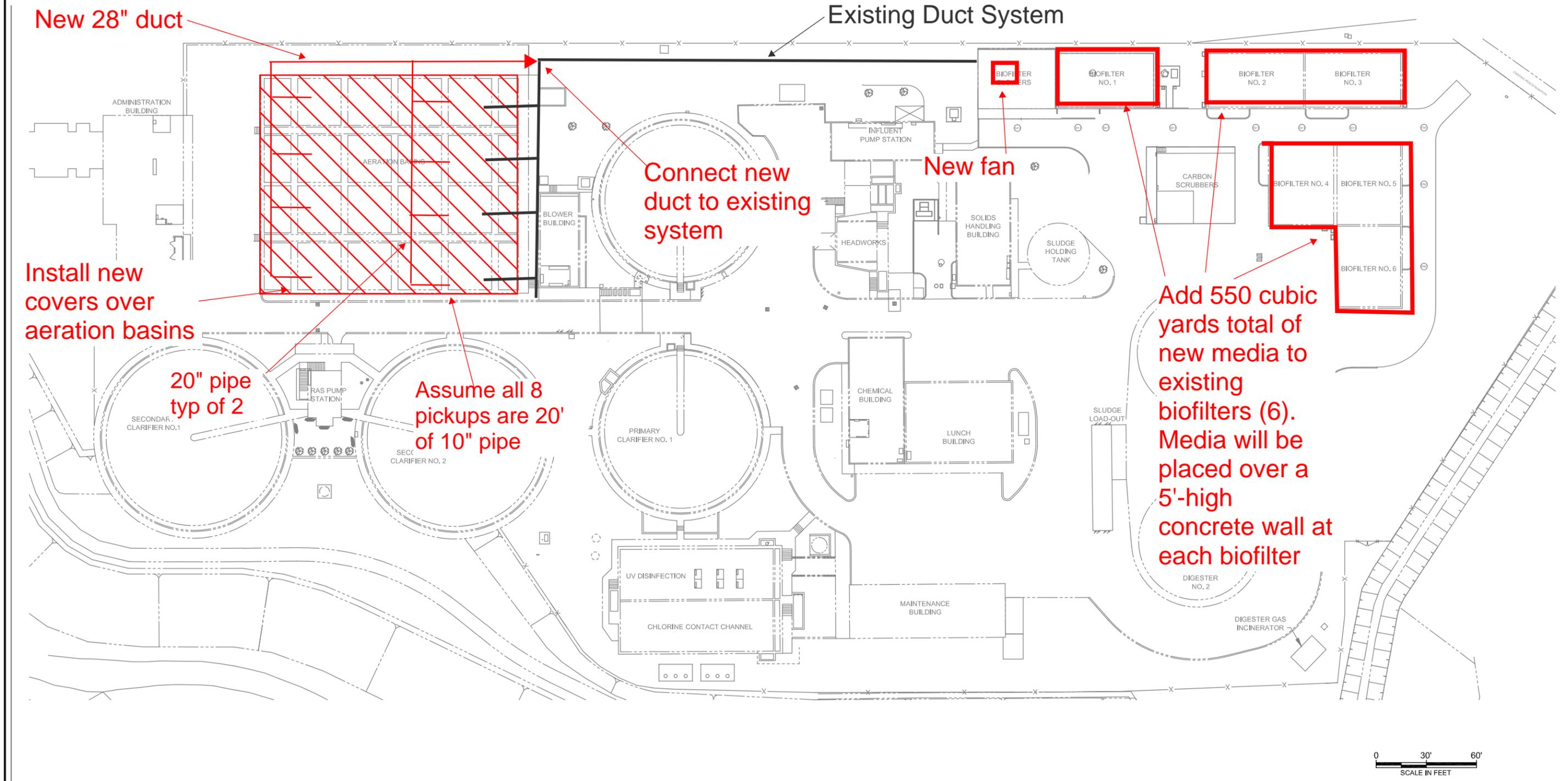
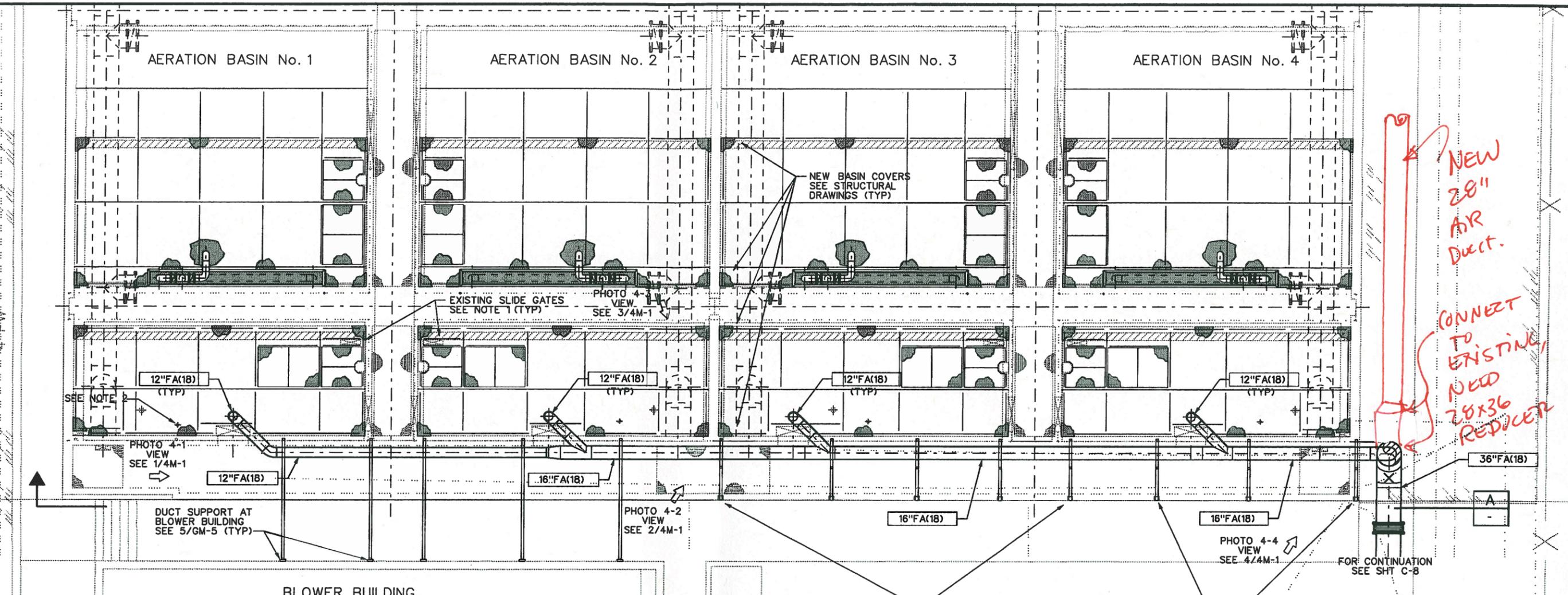
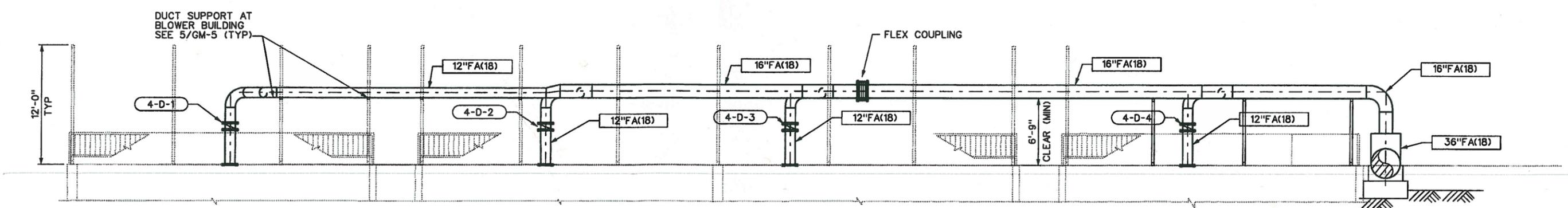


FIGURE 1
SITE PLAN AND VICINITY MAP

Path: P:\14174 WES Kellogg WWTP Odor Study Follow Up\Graphics\... Filename: 139881-CIVIL-SITE-PLAN Plot date: Aug 19, 2013 04:54:17pm CAD User: rkingery. Xref Filename: 134720-MF-002 | 134720-MF-E-002 |



PLAN 1



SECTION A

- NOTES:
1. SHORTEN EXISTING SLIDE GATE HANDLES SO THAT TOP OF HANDLES CLEAR BOTTOM OF ALUMINUM PLATE STIFFENERS OF REMOVEABLE PLATE. TYP 4 PLCS
 2. REMOVE EXISTING HANDWHEEL FROM VALVE OPERATOR AND REPLACE WITH NEW 8" DIA. GALV. HANDWHEEL. TYP. 4 BASINS



REV	DATE	BY	DESCRIPTION

SCALE 3/8" = 1'-0"	WARNING IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED RAW DRAWN DPR CHECKED GSH
-----------------------	---	--

SUBMITTED BY B.D.T.	15933	1/14/00
(PROJECT MANAGER'S NAME)	LICENSE NO.	DATE
(COMPANY OFFICER'S NAME)	LICENSE NO.	DATE

MONTGOMERY WATSON
Portland, Oregon

WATER ENVIRONMENTAL SERVICES
CLACKAMAS COUNTY- SERVICE DISTRICT No. 1
KELLOGG CREEK WATER POLLUTION CONTROL PLANT
ODOR CONTROL SYSTEM IMPROVEMENT PROJECT

MECHANICAL
AERATION BASINS
PLAN AND SECTION

SHEET
4M-2
CLIENT No.

Alternative D2. Biological Odor Control - Cover and Treat Secondary Clarifiers (15k cfm system)

Combined foul air is conveyed from the secondary clarifiers via ducts as shown to one (1) 14 ft diameter, 35 ft tall odor treatment unit. The ducts are installed above grade.

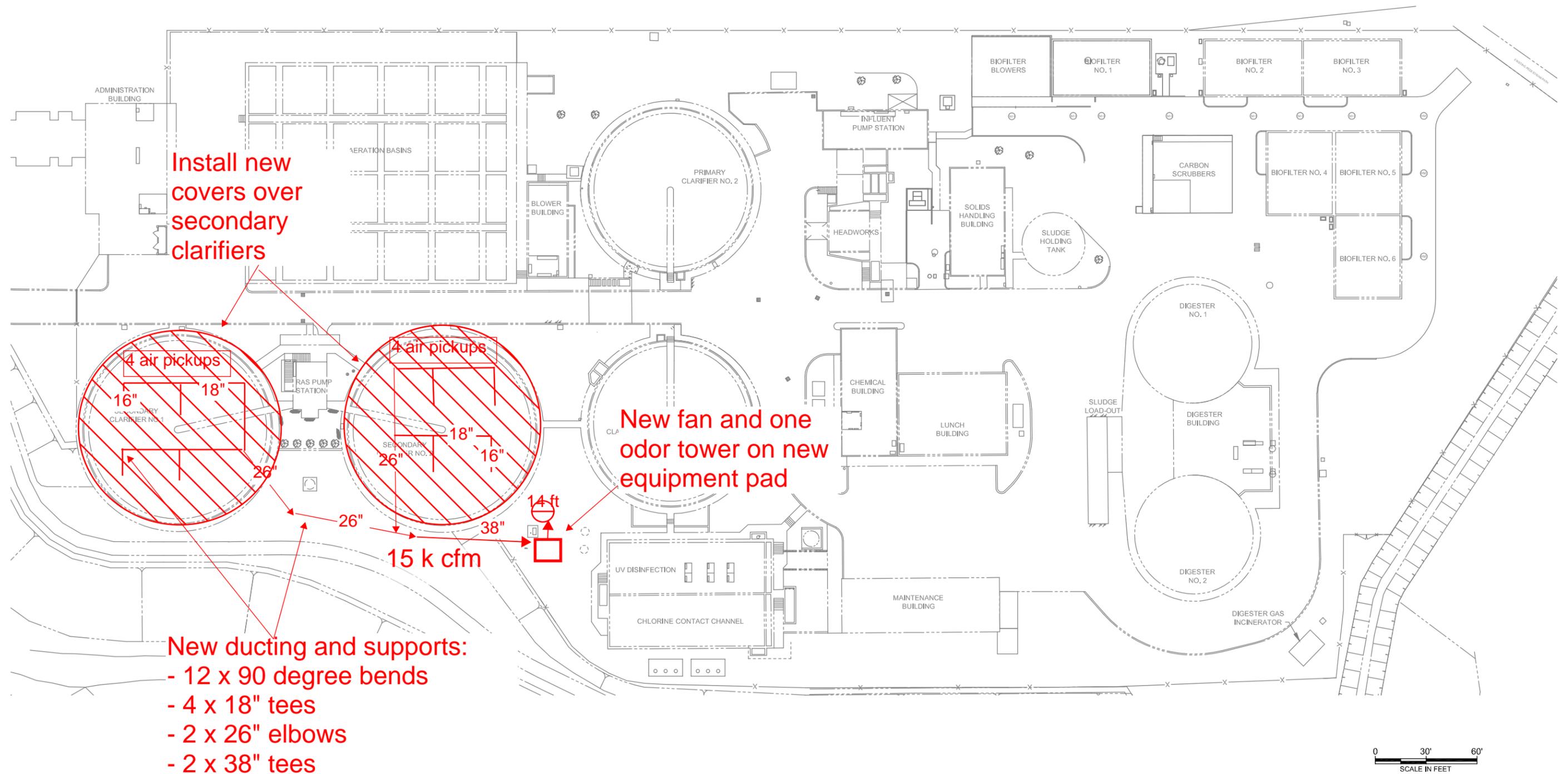


FIGURE 1
SITE PLAN AND VICINITY MAP

Alternative D3. Biological Odor Control - Cover and Treat ABs and SCs (33k cfm system)

Combined foul air is conveyed from the aeration basins and the secondary clarifiers via ducts as illustrated to two (2) 13 ft diameter, 35 ft tall odor treatment units. All ducting will be installed above grade. The 28" duct will go up and over the road with a minimum clearance of 20' to accommodate truck traffic.

Install covers on aeration basins and secondary clarifiers. Piping within each process unit is similar to Alt D1 and D2

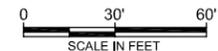
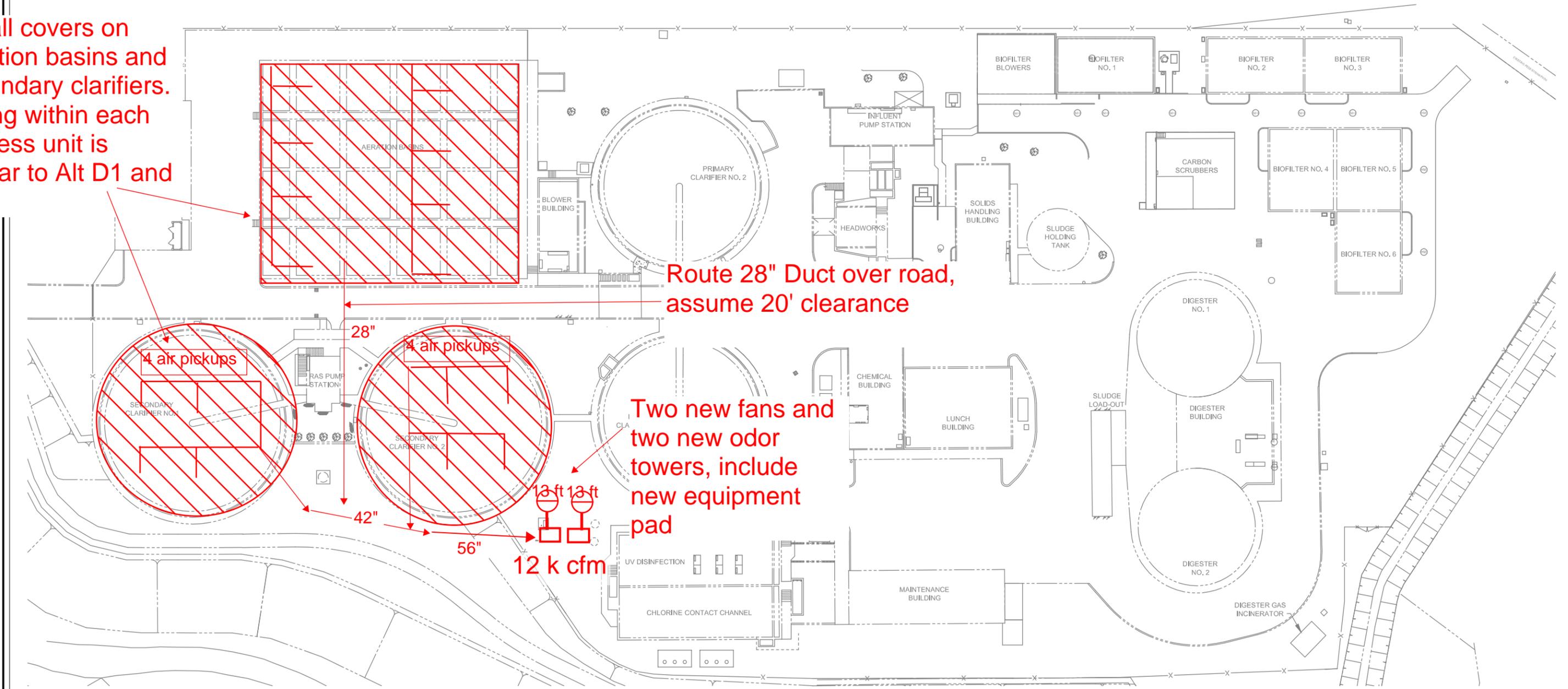


FIGURE 1
SITE PLAN AND VICINITY MAP

Path: P:\14174 WES Kellogg WWTP Odor Study Follow Up\Graphics\... File name: 139881-CIVIL-SITE-PLAN Plot date: Aug 19, 2013 04:54:17pm CAD User: rkingery. Xref File name: 134720-MF-002 | 134720-MF-E-002 |

Alternative E. Cover Existing Biofilters

Install on each of the 6 existing biofilters the following:

- fabric covers
- 15' stack
- 4000 cfm fan

Fabric cover

Stack and fan for each biofilter, (Typ)

In each biofilter, remove media as necessary to construct stack and fan support. Typ of 6

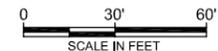
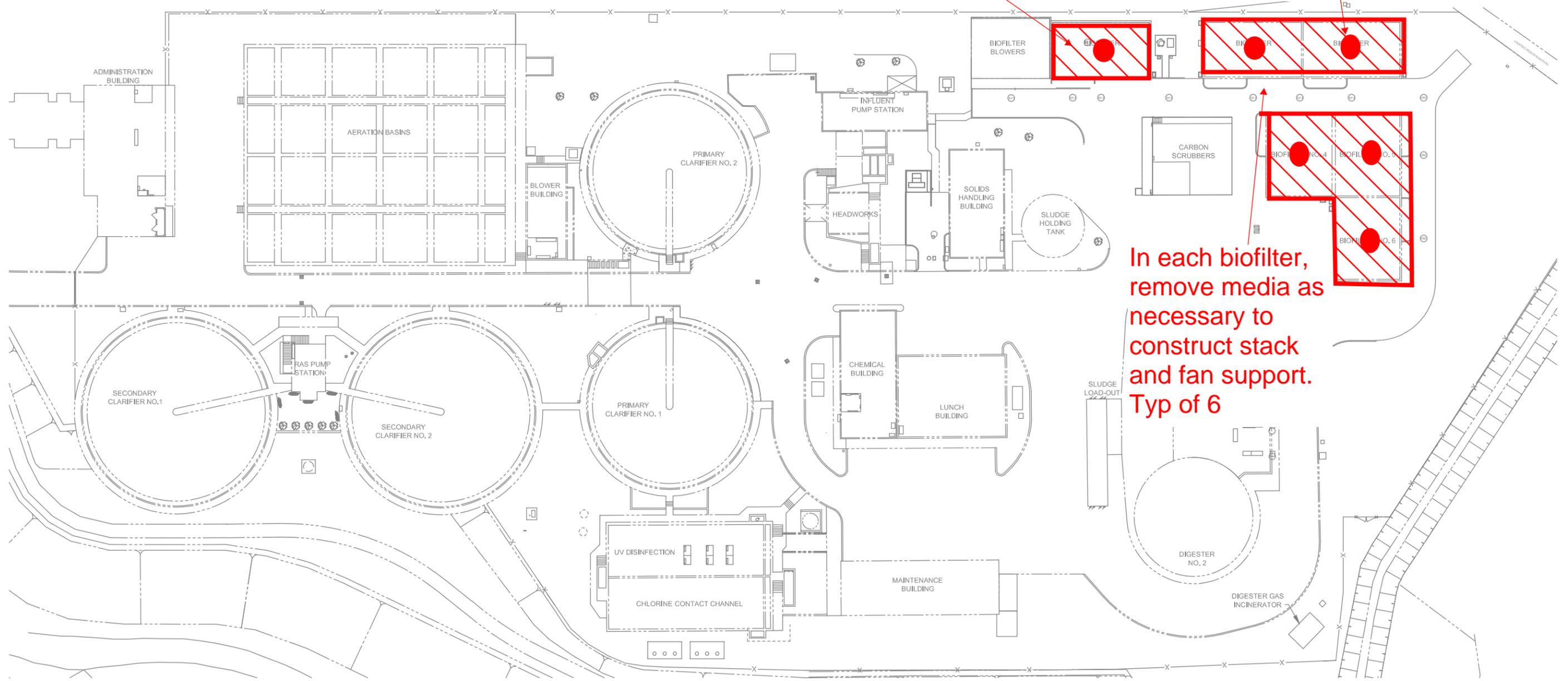
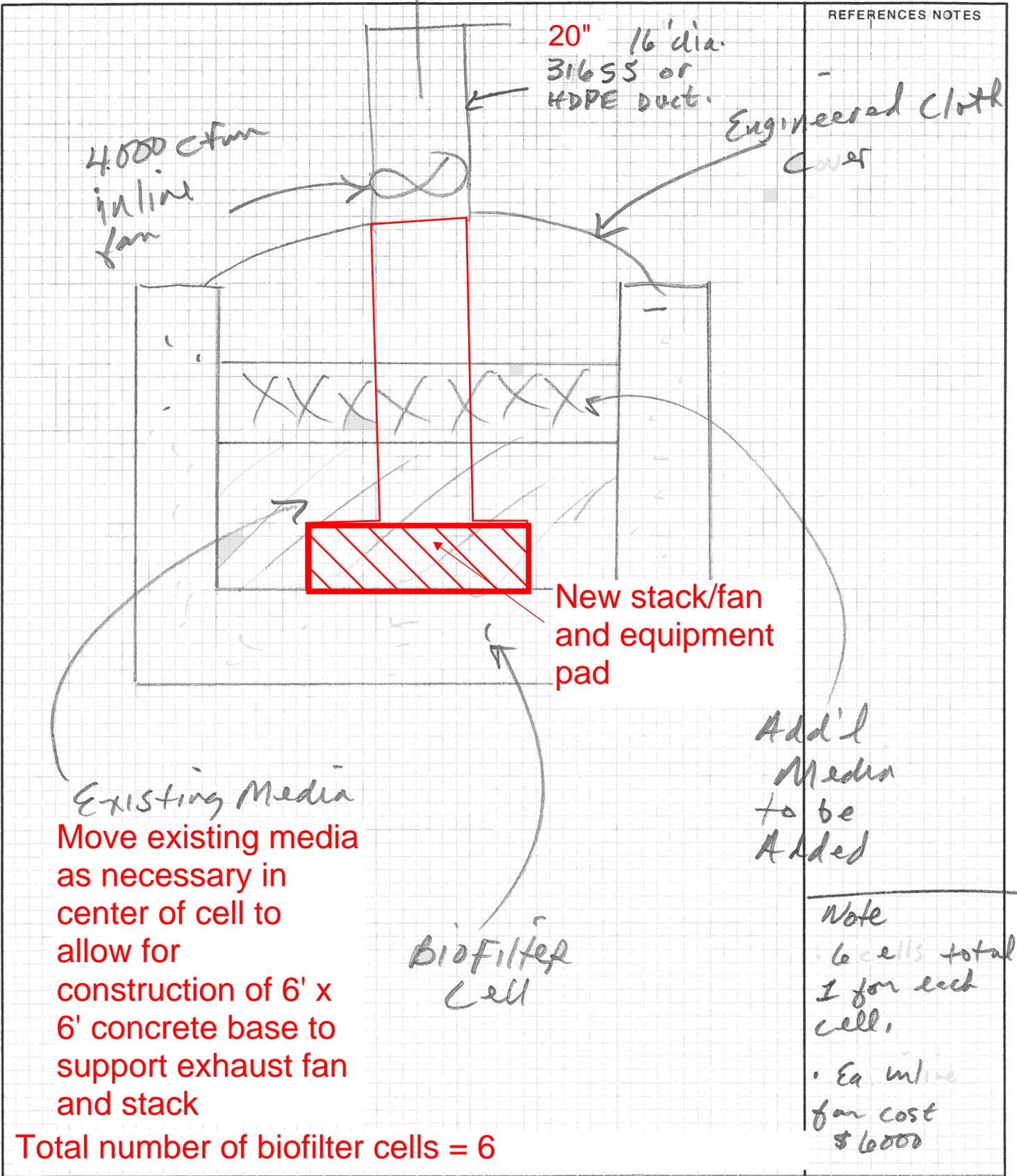


FIGURE 1
SITE PLAN AND VICINITY MAP

Alternative E. Cover Biofilters to Improve Dispersion

BROWN AND
CALDWELL



REFERENCES NOTES

DATE CHECKED	CHECKED BY	141674	MMS	8/21/13	CALC. NO.	SHEET NO. 1/1
Kellozgs Odor Ctrl Study		Section View of Biofilter Covers, Fan				
PROJECT		SUBJECT				

Alternative F. Construct Dewatering Building with Enclosed Truck Loading Area to Reduce Truck Traffic

Construct a two story building south of existing digesters. The building will contain the truck loadout with an adjacent polymer system and the centrifuge, conveyor and new electrical on the second floor. The driveway up to the building will need to be paved with asphalt to allow access. The assumed two story building dimensions was 85' L x 22' W x 33' tall. The first floor has a height of 20' and the second story has a height of 13'. Foul air from building is conveyed via a 32" duct to a 11k cfm carbon system located on the location of the existing odor tower.

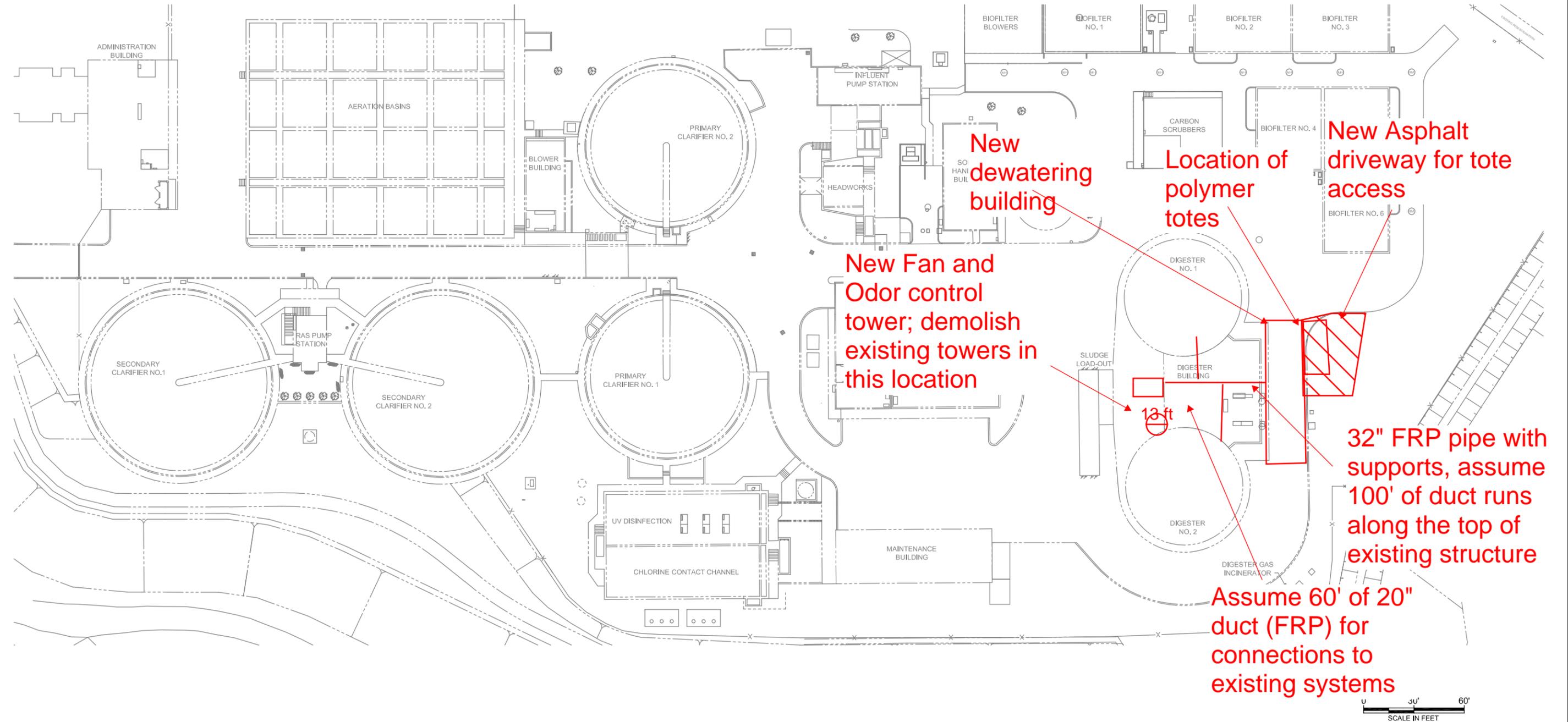
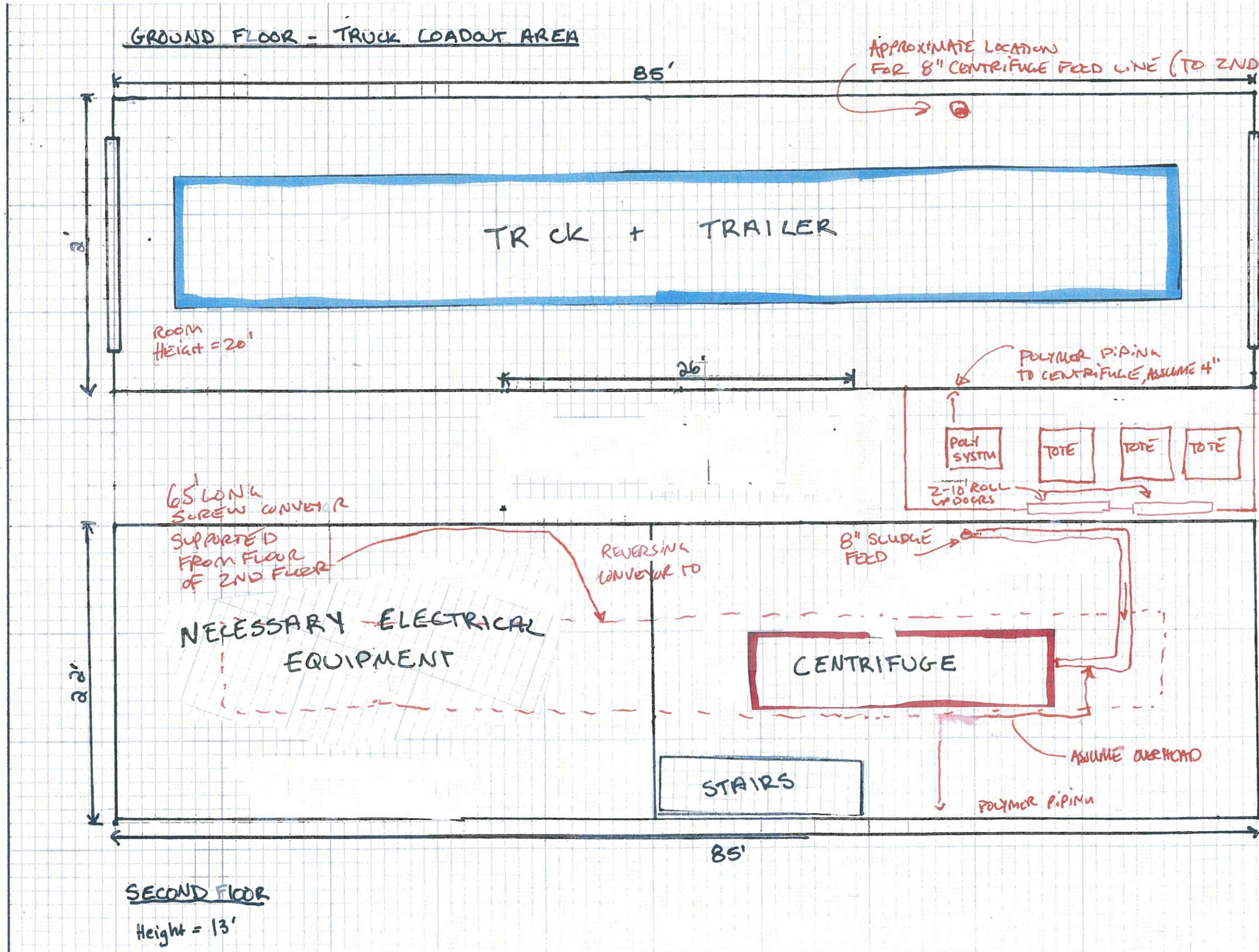


FIGURE 1
SITE PLAN AND VICINITY MAP

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
Project				Subject		

Alternative F. Enclose Biosolids Loadout Facility And Dewater Biosolids to Reduce Truck Traffic



DIMENSIONS

LIQUID HAUL TRUCK + TRAILER:
GROAT BROTHERS
TRUCK LENGTH = 30'
TRAILER LENGTH = 45'
WIDTH = 8'-6"
HEIGHT = 16'

CENTRIFUGE

LENGTH = 23.3'
WIDTH = 5.9'
HEIGHT = 8.2'

POLYMER :

WIDTH = 43" x 3.6'
DEPTH = 36" x 3'
HEIGHT = 68.5" x 5.7' } POLYMER FEED SYSTEM

Tote dimensions =

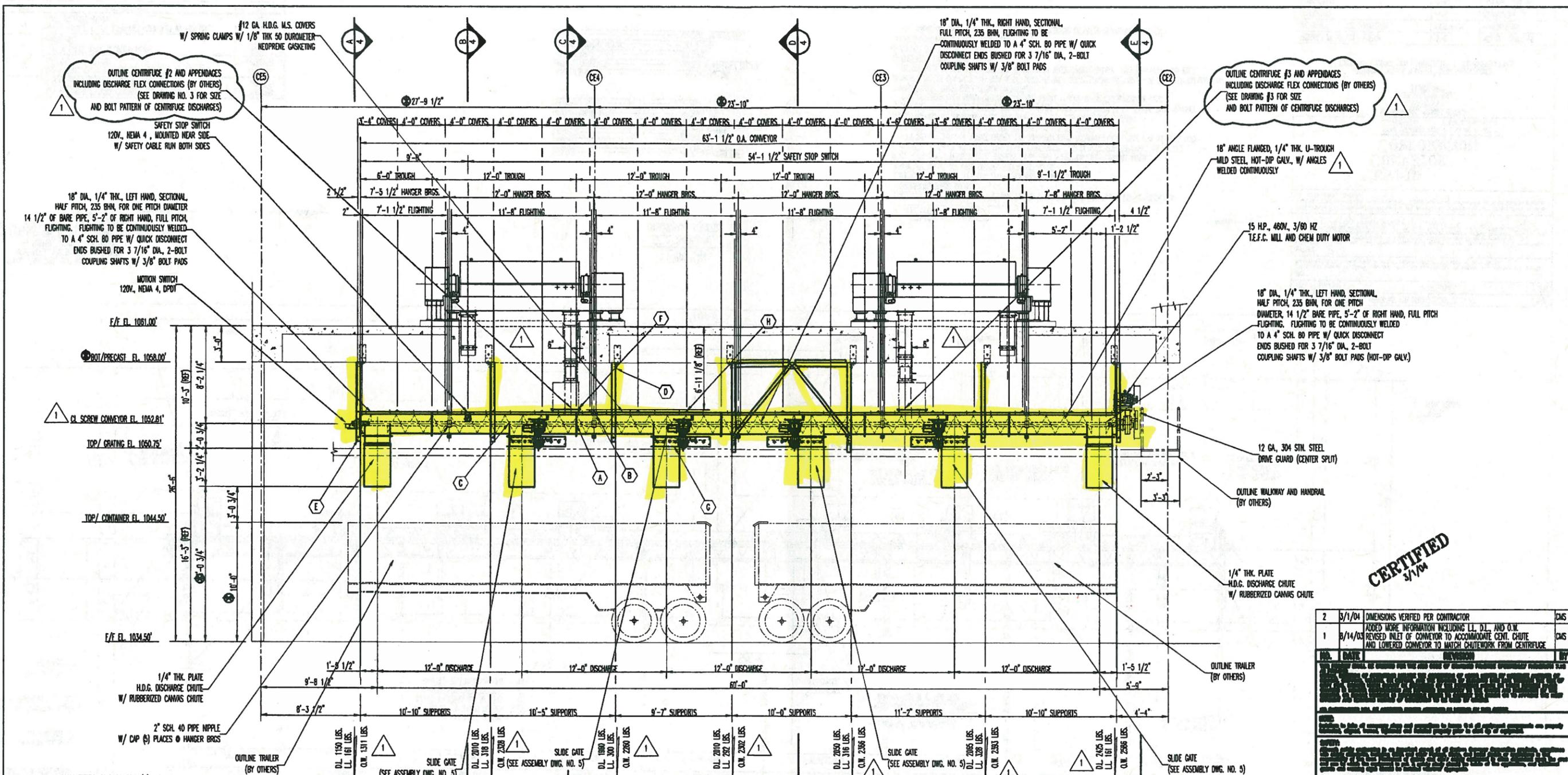
$$\frac{L}{45"} \times \frac{W}{40"} \times \frac{H}{48"} = 49.95$$

$$49.95 \times 7.48 = 374 \text{ gal}$$

STAIRS :

WIDTH = 5'
LENGTH = 15'

Scale: 1 square = 1 ft



CERTIFIED
3/1/04

QUANTITIES SHOWN FOR (1) ASSEMBLY
(2) ASSEMBLIES REQUIRED

NO.	QTY.	DESCRIPTION	UNIT
H	16	3/8 - 16NC X 1 1/4" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	COVER SPLICE
G	40	1/2 - 13NC X 1 1/2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	CHUTEWORK TO GATE
F	40	1/2 - 13NC X 1 1/2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	CHUTEWORK TO CONVEYOR
E	14	5/8 - 11NC X 1 1/2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	TROUGH SADDLE TO SUPPORT
D	28	3/4 - 10NC X 2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (ASTM A325)	CONVEYOR SUPPORT
C	40	1/2 - 13NC X 1 1/2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	GATE TO CONVEYOR
B	4	7/8" X 5 1/2" LONG COUPLING BOLTS (GRADE 5)	FLIGHT SPLICE
A	20	5/8 - 11NC X 1 1/2" LONG HEX HEAD BOLT W/ HEX NUT, FLAT AND LOCK WASHER (304 STN. STEEL)	TROUGH SPLICE
IND.			

FIELD ASSEMBLY BOLT SCHEDULE

ELEVATION
(2) ASSEMBLIES REQUIRED: SSC-1 AND SSC-2 (SSC-1 SHOWN)

ITEM	DL (LBS.)	LL (LBS.)	CLW (LBS.)
DL 1190	1190	1161	1311
DL 2010	2010	1918	2200
DL 1000	1000	900	2060
DL 2010	2010	1902	2262
DL 2050	2050	1918	2366
DL 2085	2085	1908	2383
DL 2425	2425	1911	2586

PROJECT: DEKALB COUNTY, GEORGIA
 LOCATION: DORAVILLE, GA
 ENGINEER: CDM
 MANUFACTURER: CUSTOM CONVEYOR CORPORATION
 MANUFACTURER'S RFP: HEYWARD, INC.
 APPLICABLE SPEC: 14555
 DESIGN CAPACITY: 535 CU. FT. / HR.
 MATERIAL CONVEYED: SLUDGE @ 60 LBS. / CU. FT.
 R.P.M. @ DRIVE SHAFT: 25 R.P.M.
 APPROX. SHIPPING WEIGHT: 13230 LBS.
 CONTRACTOR VERIFIED DIMENSION

- GENERAL NOTES**
- 1) ALL MILD STEEL STRUCTURAL SHAPES AND PLATES TO BE TYPE ASTM A36 MILD STEEL CONSTRUCTION UNLESS OTHERWISE NOTED
 - 2) ALL WELDING TO BE CONTINUOUS AND IN ACCORDANCE WITH AWS D1.1
 - 3) SHOP TO REMOVE ALL WELD SPATTER AND SHARP EDGES
 - 4) ALL NUTS, BOLTS, FLATS & LOCK WASHERS TO BE 304 STN. STEEL UNLESS OTHERWISE NOTED
 - 5) SCREW TROUGH, TROUGH ENDS, FLIGHTING, COVERS, GATE FRAMES AND SUPPORT FABRICATIONS TO BE PICKLED PER SSPC-SP8 AND HOT-DIP GALVANIZED PER ASTM A123
 - 6) ALL FLIGHTING TO BE TYPE AR 235 STEEL CONSTRUCTION
 - 7) COMPONENT HARDWARE IS: MOTOR, REDUCER, BEARINGS AND HANGER BEARINGS TO RECEIVE SHOP BLANKET COAT OF EPOXY OVER MANUFACTURER'S STANDARD FINISH. COLOR TO BE DETERMINED BY C.C.C.
 - 8) NON-FERROUS ITEMS SHALL REMAIN UNFINISHED.
 - 9) SHOP ASSEMBLY COMPLETE AND SHIP IN (3) SECTIONS WITH THE FOLLOWING SHIPPED LOOSE FOR FIELD INSTALLATION BY CONTRACTOR: CONVEYOR SUPPORTS, GATES, ZERO SPEED SWITCH, SAFETY CABLE AND FIELD ASSY BOLTS
 - 10) ELECTRICAL CONTROLS BY OTHERS UNLESS OTHERWISE NOTED.
 - 11) ANCHOR BOLTS TO BE BY OTHERS.
 - 12) SEE DRAWING NO. 2 & 3 FOR SECTION VIEWS.
 - 13) ALL DIMENSIONS MARKED WITH AN ASTERISK MUST BE VERIFIED BEFORE FABRICATION CAN BEGIN.
 - 14) ALL EQUIPMENT TO BE PROPERLY GREASED AND LUBRICATED PRIOR TO SHIPMENT

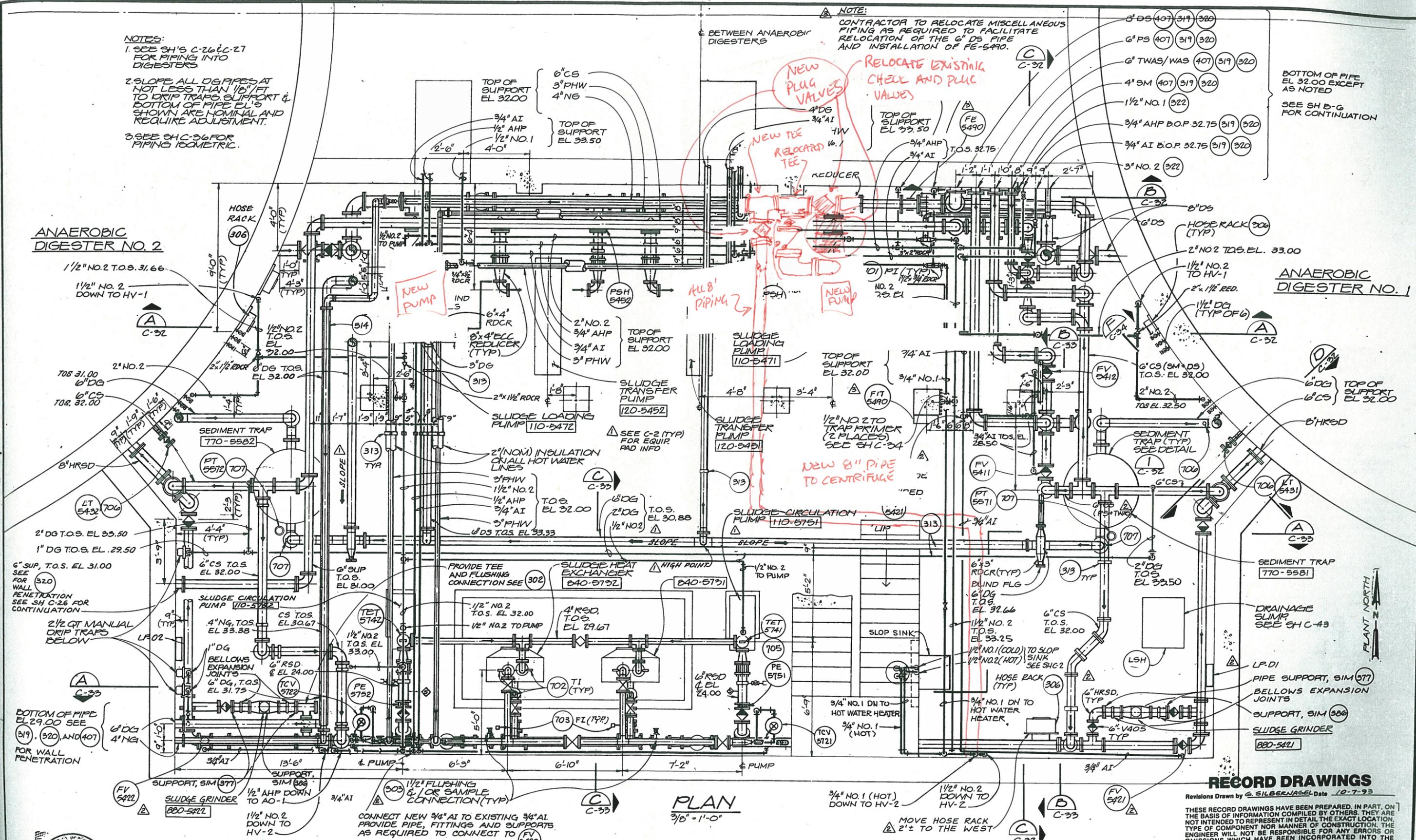
2	5/1/04	DIMENSIONS VERIFIED PER CONTRACTOR	CMC
1	6/14/03	ADDED MORE INFORMATION INCLUDING L.L. AND O.W. REVISED INLET OF CONVEYOR TO ACCOMMODATE CENT. CHUTE AND LOWERED CONVEYOR TO MATCH CHUTEWORK FROM CENTRIFUGE	CMC
NO.	DATE	REVISION	BY
<p>THIS DRAWING IS THE PROPERTY OF CUSTOM CONVEYOR CORPORATION AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF CUSTOM CONVEYOR CORPORATION. ANY UNAUTHORIZED REPRODUCTION OR TRANSMISSION OF THIS DRAWING IS STRICTLY PROHIBITED AND WILL BE PROSECUTED TO THE FULL EXTENT OF THE LAW.</p> <p>© Copyright Custom Conveyor Corp. 2004. All rights reserved. The name and all trademarks herein are the property of Custom Conveyor Corporation, used by permission and are made public or copied under no obligation by their use in design or other open channels.</p>			
<p>CUSTOM CONVEYOR CORPORATION 11500 WOODBURN RD., DORAVILLE, GA 30095 770-422-2222 FAX 770-422-2228</p>			
<p>FOR: HEYWARD, INC. / SCOTT CANTON WATER FILTER PLANT / DORAVILLE, GA</p>			
<p>DESCRIPTION: ASSEMBLY 18" DIA. REVERSING SLUDGE SCREW CONVEYOR W/ SLIDE GATES AND INLET CHUTES</p>			
DESIGNED BY	CMC	DATE	03/01/04
DRAWN BY	CHRIS STODER	DATE	02-03
CHECKED BY		DATE	02/09/04
APPROVED BY		DATE	03/01/04

NOTES:
 1. SEE SH'S C-26 & C-27 FOR PIPING INTO DIGESTERS
 2. SLOPE ALL DG PIPES AT NOT LESS THAN 1/8" FT TO DRIP TRAPS, SUPPORT & BOTTOM OF PIPE ELS SHOWN ARE NOMINAL AND REQUIRE ADJUSTMENT.
 3. SEE SH C-26 FOR PIPING ISOMETRIC.

NOTE:
 CONTRACTOR TO RELOCATE MISCELLANEOUS PIPING AS REQUIRED TO FACILITATE RELOCATION OF THE 6" DS PIPE AND INSTALLATION OF FE-5490.

ANAEROBIC DIGESTER NO. 2

ANAEROBIC DIGESTER NO. 1



PLAN
 3/8" = 1'-0"

RECORD DRAWINGS

Revisions Drawn by G. SILBERNAGEL Date 10-7-93
 THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.



CH2M HILL	DSGN	M.C. KEMP / A.R. PLAYLOCK	10/93	RECORD DRAWINGS
	DR	V.A. PETERS	4/92	MISCELLANEOUS PLANT MODIFICATIONS
	CHK	BOB YORK	4/87	RECORD DRAWINGS
	APVD	GOETZ	10/85	ADDENDUM NO. 1

NO.	DATE	REVISION
1	10/93	RECORD DRAWINGS
2	4/92	MISCELLANEOUS PLANT MODIFICATIONS
3	4/87	RECORD DRAWINGS
4	10/85	ADDENDUM NO. 1

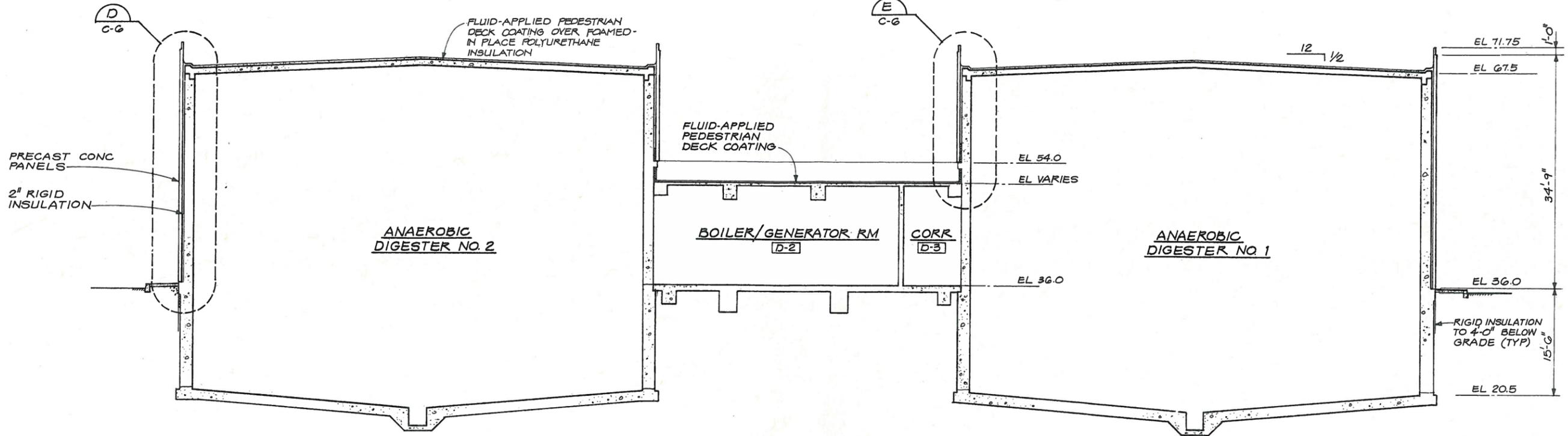
REUSE OF DOCUMENTS
 THIS DOCUMENT, AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF CH2M HILL AND IS NOT TO BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF CH2M HILL.
 © CH2M HILL, INC.

VERIFY SCALES
 BAR IS ONE INCH ON ORIGINAL DRAWING.
 IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

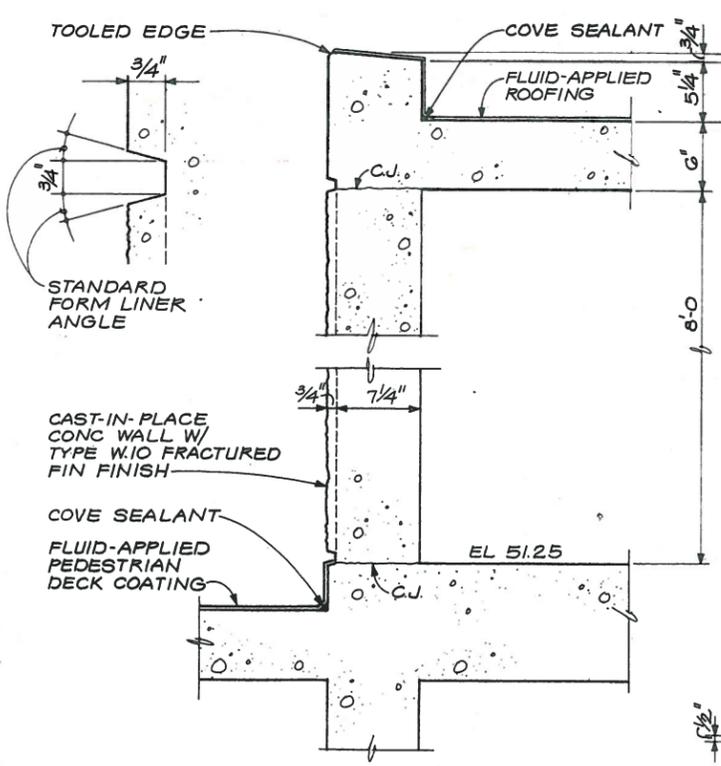
SERVICE DISTRICT NO. 1
CLACKAMAS COUNTY, OREGON
KELLOGG CREEK
WATER POLLUTION CONTROL PLANT

DIGESTER COMPLEX
BUILDING MECHANICAL LOWER LEVEL PLAN
DIGESTED SLUDGE FLOW METER

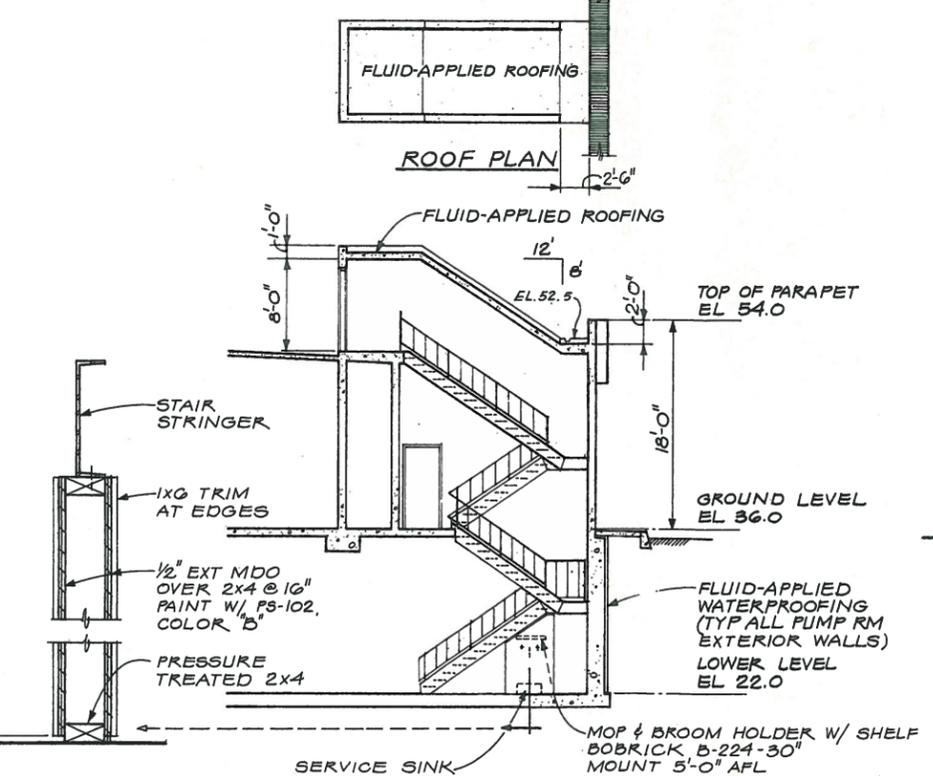
SHEET C-29
 DATE APRIL 1984
 PROJ. NO. P 15901.A1



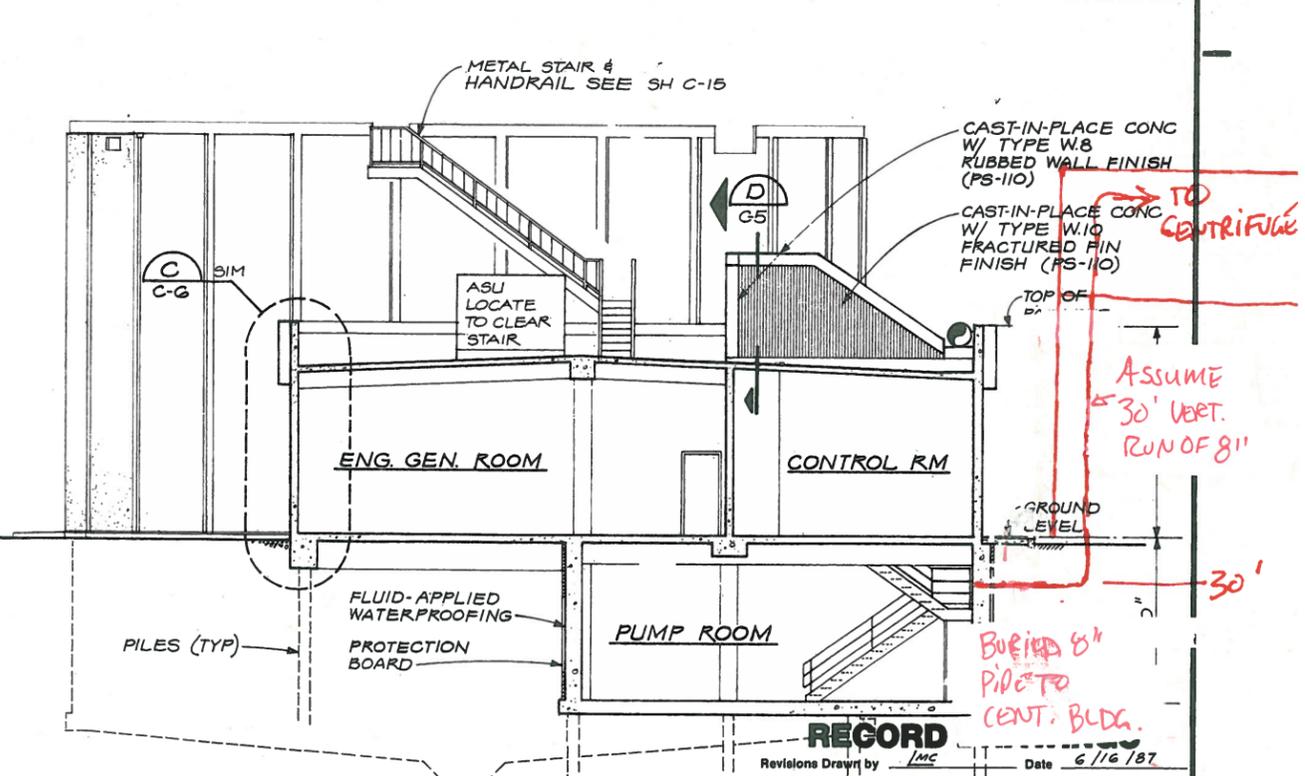
BUILDING SECTION (A)
 1/8" = 1'-0" C-1, C-2, C-3



WALL SECTION (D)
 1/2" = 1'-0" C-4, C-5



PARTIAL SECTION (C)
 1/8" = 1'-0" C-1, C-2, C-3



BUILDING SECTION (B)
 1/8" = 1'-0" C-1, C-2, C-3

TO CENTRIFUGE
ASSUME 30' VERT. RUN OF 8"
BURIED 8" PIPE TO CENT. BLDG.

RECORD
 Revisions Drawn by *lmc* Date *6/16/87*

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.



CH2M HILL
 DSGN *LeBower*
 DR *LeBower*
 CHK *JACK PRUSS*
 APVD *GOETZ*

NO.	DATE	REVISION	BY	APVD
	4/87	RECORD DRAWINGS	JBL	JBL

VERIFY SCALES
 BAR IS ONE INCH ON ORIGINAL DRAWING.
 0 1"
 IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

SERVICE DISTRICT NO. 1
CLACKAMAS COUNTY, OREGON
KELLOGG CREEK
WATER POLLUTION CONTROL PLANT

DIGESTER COMPLEX
BUILDING ARCHITECTURAL SECTIONS

SHEET **C-5**
 DATE **APRIL 1984**
 PROJ. NO. **P 15901.A1**

Appendix C: BC Cost Estimate



SUMMARY ESTIMATE REPORT WITH MARK-UPS ALLOCATED

WWTP Odor Study CCSD No. 1 Kellogg Facility Conceptual Estimates of Alternatives

Project Number: 141674-401-001

BC Project Manager: Dan Laffitte

BC Office: Portland

Estimate Issue Number: 00

Estimate Original Issue Date: September 10, 2013

Estimate Revision Number: 03

Estimate Revision Date: November 5, 2013

Lead Estimator: Don Snowden

Estimate QA/QC Reviewer: Butch Matthews

Estimate QA/QC Date: August 29, 2013

PROCESS LOCATION/AREA INDEX

B - Scum Pit Ventilation Improvements

C - Enclose Biosolids Load Out Facility

D1 - Cover & Treat Aeration Basins

D1B - Cover & Treat Aeration Basins (Engineered Media)

D2 - Cover & Treat Secondary Clarifiers

D3 - Cover & treat Abs and SCs

E - Cover Biofilters to Improve Dispersion

F - Dewatering Addition

Description	Total w/ Markups Allocated
--- Base Estimate ---	21,373,179
B - Scum Pit Ventilation Improvements	
02 - Site Construction	21,915
03 - Concrete	39,955
05 - Metals	5,041
13 - Special Construction	90,250
15 - Mechanical	84,391
B - Scum Pit Ventilation Improvements Total	241,552
C - Enclose Biosolids Load Out Facility	
02 - Site Construction	8,053
03 - Concrete	24,959
05 - Metals	1,419
08 - Doors & Windows	23,531
11 - Equipment	512,941
13 - Special Construction	695,277
15 - Mechanical	92,453
16 - Electrical	74,459
C - Enclose Biosolids Load Out Facility Total	1,433,092
D1 - Cover & Treat Aeration Basins	
03 - Concrete	6,307
05 - Metals	50,639
06 - Wood & Plastics	1,414,193
11 - Equipment	79,990
13 - Special Construction	135,375
15 - Mechanical	503,002
D1 - Cover & Treat Aeration Basins Total	2,189,506
D1B - Cover & Treat Aeration Basins (Engineered Media)	
03 - Concrete	6,307
05 - Metals	50,639
06 - Wood & Plastics	1,414,193
11 - Equipment	338,743
13 - Special Construction	135,375
15 - Mechanical	503,002
D1B - Cover & Treat Aeration Basins (Engineered Media) Total	2,448,258

Description	Total w/ Markups Allocated
D2 - Cover & Treat Secondary Clarifiers	
02 - Site Construction	12,745
03 - Concrete	84,052
05 - Metals	86,310
06 - Wood & Plastics	1,828,006
11 - Equipment	641,176
13 - Special Construction	140,326
15 - Mechanical	556,000
16 - Electrical	49,639
D2 - Cover & Treat Secondary Clarifiers Total	3,398,254
D3 - Cover & treat Abs and SCs	
02 - Site Construction	35,346
03 - Concrete	143,760
05 - Metals	62,934
06 - Wood & Plastics	3,242,199
11 - Equipment	1,025,882
13 - Special Construction	180,500
15 - Mechanical	695,793
16 - Electrical	49,639
D3 - Cover & treat Abs and SCs Total	5,436,053
E - Cover Biofilters to Improve Dispersion	
01 - General Requirements	10,355
02 - Site Construction	4,878
13 - Special Construction	1,545,044
15 - Mechanical	266,467
16 - Electrical	74,459
E - Cover Biofilters to Improve Dispersion Total	1,901,203
F - Dewatering Addition	
01 - General Requirements	1,872
02 - Site Construction	38,953
03 - Concrete	12,054
05 - Metals	7,849
08 - Doors & Windows	34,088
09 - Finishes	6,668
11 - Equipment	2,476,901

Description	Total w/ Markups Allocated
13 - Special Construction	1,074,743
15 - Mechanical	297,355
16 - Electrical	374,778
F - Dewatering Addition Total	4,325,262



DETAILED ESTIMATE REPORT

WWTP Odor Study
CCSD No. 1 Kellogg Facility
Conceptual Estimates of Alternatives

Project Number: 141674-401-001

BC Project Manager: Dan Laffitte

BC Office: Portland

Estimate Issue Number: 00

Estimate Original Issue Date: September 10, 2013

Estimate Revision Number: 03

Estimate Revision Date: November 5, 2013

Lead Estimator: Don Snowden

Estimate QA/QC Reviewer: Butch Matthews

Estimate QA/QC Date: August 29, 2013

PROCESS LOCATION/AREA INDEX

B - Scum Pit Ventilation Improvements
C - Enclose Biosolids Load Out Facility
D1 - Cover & Treat Aeration Basins
D1B - Cover & Treat Aeration Basins (Engineered Media)
D2 - Cover & Treat Secondary Clarifiers
D3 - Cover & treat Abs and SCs
E - Cover Biofilters to Improve Dispersion
F - Dewatering Addition

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
--- Base Estimate ---										
B - Scum Pit Ventilation Improvements										138,320
02200 - Site Preparation										
02210200 - Core Drilling										
1700	Concrete core drilling, core, reinforced concrete slab, 18" diameter, up to 6" thick wall, includes bit, layout and set up	2.0	EA	124.19	2.93		12.26		139.38	279
1750	Concrete core drilling, core, reinforced concrete slab, 18" diameter, up to 6" thick wall, includes bit, layout and set up, each added inch thick in same hole, add	12.0	EA	7.78	0.49		0.77		9.03	108
Site Preparation Total										387
02300 - Earthwork										
02315120 - Backfill, Structural										
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul, from existing stockpile, excludes compaction	369.0	L.C.Y.	1.27			1.69		2.96	1,091
02315310 - Compaction, General										
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	332.1	E.C.Y.	2.22			0.40		2.62	871
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	2.8	E.C.Y.	3.33			0.61		3.94	11
02315492 - Hauling										
0009	Loading Trucks, F.E. Loader, 3 C.Y.	53.2	cuyd	0.96			1.13		2.09	111
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	53.2	L.C.Y.	3.49			4.60		8.09	430
02315610 - Excavating, Trench										

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	337.8	B.C.Y.	5.84			1.82		7.66	2,586
Earthwork Total										5,101
02450 - Foundation & Load Bearing Elements										
02455900 - Mobilization										
0500	Mobilization, to 36", set up and remove drill rig, for caissons, minimum	1.0	EA	3,345.05			2,427.95		5,773.00	5,773
02465800 - Drilled Caissons										
0110	Fixed end caisson piles, open style in stable ground, to 50' deep, 18" diameter, 0.065 C.Y./L.F., machine drilled, includes excavation, concrete, 50 lb. reinforcing/C.Y., excludes mobilization, boulder removal, disposal, casings or ground water	40.0	vlft	16.68	7.90		12.21		36.78	1,471
Foundation & Load Bearing Elements Total										7,244
03100 - Concrete Forms & Accessories										
03110430 - Forms In Place, Footings										
5050	C.I.P. concrete forms, footing, spread, plywood, 2 use, includes erecting, bracing, stripping and cleaning	1,760.3	sfca	6.56	1.11				7.67	13,497
Concrete Forms & Accessories Total										13,497
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	2,222.1	lb	0.64	0.50				1.14	2,540
2000	Reinforcing steel, unload and sort, add to base	1.1	ton	48.77			6.98		55.75	62
2210	Reinforcing steel, crane cost for handling, average, add	1.1	ton	52.32			7.56		59.87	67
Concrete Reinforcement Total										2,669
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	22.5	CY		102.00				102.00	2,294
	03310700 - Placing Concrete									
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	22.5	CY	22.29			4.17		26.46	595
	03350350 - Finishing Walls									
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	1,259.6	SF	3.25					3.25	4,094
	Cast-In-Place Concrete Total									6,984
	05050 - Basic Metal Materials & Methods									
	05090080 - Anchor Bolts									
0130	Anchor bolt, J-type, 2-bolt set, plain steel, 3/4" dia x 8" L, incl nut & washer, job-built 2-hole template	50.0	set	32.71	10.85				43.56	2,178
	Basic Metal Materials & Methods Total									2,178
	05500 - Metal Fabrications									
	05580950 - Miscellaneous Fabrication									
0990bc	Fabricated Pipe Strap	407.6	lb	1.00	0.80		0.03		1.83	746
	Metal Fabrications Total									746
	13080 - Sound, Vibration & Seismic Control									
	13081200 - Sound Traps									
0045DG	Enclosures, sound @ existing fans	2.0	each	328.01	25,200.00				25,528.01	51,056
	Sound, Vibration & Seismic Control Total									51,056
	15050 - Basic Materials & Methods									
	15050010 - Miscellaneous Mechanical									

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
0430	piping, cut-in, 16", existing line	1.0	each	1,066.04					1,066.04	1,066
Basic Materials & Methods Total										1,066
15100 - Building Services Piping										
15107620 - Pipe, Steel										
2200	Pipe, steel, black, welded, 20" diameter, schedule 40, Spec. A-53, includes two rod, roll hanger & saddle, sized for covering, 10' OC (bridge casing)	30.0	LF	213.38	148.12		4.08		365.58	10,967
Building Services Piping Total										10,967
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0010	Duct, FRP, 10" dia.	85.0	lnft	91.90	19.00				110.90	9,427
B0016	Duct, FRP, 16" dia.	150.0	lnft	110.28	29.00				139.28	20,892
B10E	Fitting, FRP, 90 Elbow, 10" dia.	4.0	ea	459.50	89.00				548.50	2,194
B10E2	Fitting, FRP, 45 Elbow, 10" dia.	2.0	ea	303.27	71.00				374.27	749
B16T	Pipe, fitting, fbgl., 16" Tee	1.0	ea	426.42	123.17				549.58	550
15200300 - Expansion Couplings										
0020	Pipe, steel ftngs, flg cplg adapter, 16" (bridge)	2.0	each	1,018.82	258.68				1,277.50	2,555
Process Piping Total										36,366
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork	1.0	EA			59.00			59.00	59
Testing/Adjusting/Balancing Total										59

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
C - Enclose Biosolids Load Out Facility										873,363
02200 - Site Preparation										
02220452 - Seletive Demolition - Equipment Dismantling										
0980	Equipment dismantling/demolition, odor control vessel, complete	1.0	lsum	2,205.60			292.71		2,498.31	2,498
Site Preparation Total										2,498
02300 - Earthwork										
02315120 - Backfill, Structural										
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul, from existing stockpile, excludes compaction	137.8	L.C.Y.	1.27			1.69		2.96	407
02315310 - Compaction, General										
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	124.0	E.C.Y.	2.22			0.40		2.62	325
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	1.2	E.C.Y.	3.33			0.61		3.94	5
02315492 - Hauling										
0009	Loading Trucks, F.E. Loader, 3 C.Y.	21.0	cuyd	0.96			1.13		2.09	44
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment (odor control vessel)	30.0	L.C.Y.	3.49			4.60		8.09	243
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	21.0	L.C.Y.	3.49			4.60		8.09	170
02315610 - Excavating, Trench										
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	127.0	B.C.Y.	5.84			1.82		7.66	973

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
Earthwork Total										2,167
03100 - Concrete Forms & Accessories										
03110430 - Forms In Place, Footings										
5050	C.I.P. concrete forms, footing, spread, plywood, 2 use, includes erecting, bracing, stripping and cleaning	256.5	sfca	6.56	1.11				7.67	1,967
03110445 - Forms In Place, Slab On Grade										
3550	C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	86.3	LF	13.94	0.80				14.74	1,271
Concrete Forms & Accessories Total										3,238
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	2,661.9	lb	0.64	0.50				1.14	3,043
2000	Reinforcing steel, unload and sort, add to base	2.4	ton	48.77			6.98		55.75	134
2210	Reinforcing steel, crane cost for handling, average, add	2.4	ton	52.32			7.56		59.87	144
2450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add	2,138.2	lb	1.86	0.55				2.41	5,157
Concrete Reinforcement Total										8,478
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	17.4	CY		102.00				102.00	1,773
03310700 - Placing Concrete										
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	17.4	CY	22.29			4.17		26.46	460

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
03350300 - Finishing Floors										
0150	Concrete finishing, floors, basic finishing for unspecified flatwork, bull float, manual float & broom finish, includes edging and joints, excludes placing, striking off & consolidating	237.1	SF	0.87					0.87	207
03350350 - Finishing Walls										
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	101.2	SF	3.25					3.25	329
Cast-In-Place Concrete Total									2,769	
05050 - Basic Metal Materials & Methods										
05090080 - Anchor Bolts										
0130	Anchor bolt, J-type, 2-bolt set, plain steel, 3/4" dia x 8" L, incl nut & washer, job-built 2-hole template	12.0	set	32.71	10.85				43.56	523
Basic Metal Materials & Methods Total									523	
05500 - Metal Fabrications										
05580950 - Miscellaneous Fabrication										
0990bc	Fabricated Pipe Strap	164.4	lb	1.00	0.80		0.03		1.83	301
Metal Fabrications Total									301	
08300 - Specialty Doors										
08360550 - Overhead, Commercial										
2800	Doors, overhead, commercial, stock, steel, heavy duty, sectional, chain hoist, 16' x 16' high	2.0	EA	1,707.69	3,405.63				5,113.32	10,227
2950	Doors, overhead, commercial, stock, steel, heavy duty, sectional, for electric trolley operator, 1/2 HP, over 16' x 16', add	2.0	EA	656.02	1,100.00				1,756.02	3,512
Specialty Doors Total									13,739	
11000 - Equipment										
11000100 - Process Equipment										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
1140	Odor control tower, complete w/ media	1.0	each			310,000.00			310,000.00	310,000
Equipment Total										310,000
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing and new fans	3.0	each	328.01	25,200.00				25,528.01	76,584
Sound, Vibration & Seismic Control Total										76,584
13130 - Buildings and Structures										
13130300 - Wastewater Treatment Structures										
003	Load Out Building	1,870.0	SF					190.00	190.00	355,300
Buildings and Structures Total										355,300
15050 - Basic Materials & Methods										
15050010 - Miscellaneous Mechanical										
0260	piping, connect to existing 20" pipe	1.0	each	2,297.50	294.44		28.81		2,620.75	2,621
Basic Materials & Methods Total										2,621
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0020	Duct, FRP, 20" dia.	60.0	lnft	119.47	48.00				167.47	10,048
B0032	Duct, FRP, 32" dia.	40.0	lnft	183.57	83.42				266.99	10,680
B20E	Fitting, FRP, 90 Elbow, 20" dia.	1.0	ea	808.72	324.00				1,132.72	1,133
B20E2	Fitting, FRP, 45 Elbow, 20" dia.	2.0	ea	533.76	195.00				728.76	1,458
B30E	Fitting, FRP, 90 Elbow, 32" dia.	1.0	ea	1,388.87	684.73				2,073.60	2,074
B32T	Pipe, fitting, fbgl., 32" Tee	1.0	ea	869.65	312.34				1,181.99	1,182
Process Piping Total										26,574

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
15700 - Heating/Ventilating/Air Conditioning Equipment										
15700200 - Fans										
0080	Fans, supply, 11,000 scfm, frp construction	1.0	each	3,152.16	20,361.00				23,513.16	23,513
Heating/Ventilating/Air Conditioning Equipment Total										23,513
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork	1.0	EA			59.00			59.00	59
Testing/Adjusting/Balancing Total										59
16000 - Electrical and Instrumentation										
16000000 - Electrical and Instrumentation										
0001	Electrical and Instrumentation Subcontract	1.0	Isum			45,000.00			45,000.00	45,000
Electrical and Instrumentation Total										45,000

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
D1 - Cover & Treat Aeration Basins										1,270,975
03100 - Concrete Forms & Accessories										
03110425 - Forms In Place, Equipment Foundations										
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	52.7	sfca	20.07	1.70				21.77	1,147
03110445 - Forms In Place, Slab On Grade										
3550	C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	36.0	LF	13.94	0.80				14.74	530
Concrete Forms & Accessories Total										1,677
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	449.5	lb	0.64	0.50				1.14	514
2000	Reinforcing steel, unload and sort, add to base	0.4	ton	48.77			6.98		55.75	22
2210	Reinforcing steel, crane cost for handling, average, add	0.4	ton	52.32			7.56		59.87	24
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	35.7	EA	3.10	1.15				4.25	151
2450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add	262.6	lb	1.86	0.55				2.41	633
Concrete Reinforcement Total										1,345
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	2.5	CY		102.00				102.00	254
03310700 - Placing Concrete										

Clackamas County WES

**WWTP Odor Study
CCSD No. 1 Kellogg Facility**

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	2.5	CY	22.29			4.17		26.46	66
	03350300 - Finishing Floors									
0150	Concrete finishing, floors, basic finishing for unspecified flatwork, bull float, manual float & broom finish, includes edging and joints, excludes placing, striking off & consolidating	36.0	SF	0.87					0.87	31
	03350350 - Finishing Walls									
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	52.7	SF	3.25					3.25	171
0750	Concrete finishing, walls, sandblast, heavy penetration	13.4	SF	6.06	1.49		0.56		8.11	108
	Cast-In-Place Concrete Total									632
	05050 - Basic Metal Materials & Methods									
	05090340 - Drilling									
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	232.0	EA	13.12	0.05				13.17	3,056
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	35.7	EA	13.67	0.08				13.75	490
	05090380 - Expansion Anchors									
8150	Wedge anchor, carbon steel, 3/8" dia x 2-1/4" L, in concrete, brick or stone, excl layout & drilling	232.0	EA	4.52	0.51				5.03	1,167
	05090540 - Machinery Anchors									
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	68.0	EA	71.08	104.00		6.08		181.16	12,319
	05090900 - Welding Structural									
2010	Welding structural steel in field, 4 passes, 0.7 Lb/LF, 1/2" thick, continuous fillet, type 6011	222.7	LF	33.76	1.52		5.53		40.80	9,086
	Basic Metal Materials & Methods Total									26,117

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
05100 - Structural Metal Framing										
05120560 - Plates										
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	167.0	SF		19.90				19.90	3,323
Structural Metal Framing Total										3,323
06500 - Structural Plastics										
06520175 - Floor Grating, Fiberglass										
0100	Aluminum Floor Planking, with framing	13,500.0	SF	7.71	53.33		0.37		61.41	829,010
Structural Plastics Total										829,010
11000 - Equipment										
11000100 - Process Equipment										
0010	Biofilter Media (hand spread)	14,850.0	cuft	0.95	1.85		0.27		3.08	45,670
Equipment Total										45,670
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing and new fans	3.0	each	328.01	25,200.00				25,528.01	76,584
Sound, Vibration & Seismic Control Total										76,584
15050 - Basic Materials & Methods										
15050010 - Miscellaneous Mechanical										
0260	piping, connect to existing 10 inch	8.0	each	317.35	40.67		3.98		362.00	2,896
0260	piping, connect to existing 36 inch	2.0	each	1,293.95	165.83		16.23		1,476.00	2,952
0430	piping, cut-in, 36", existing line	1.0	each	2,398.59					2,398.59	2,399
15060300 - Pipe Hangers And Supports										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
3390	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 10" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	16.0	EA	14.74	242.00				256.74	4,108
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 28" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	46.0	EA	157.99	2,589.00				2,746.99	126,361
Basic Materials & Methods Total										138,716
15100 - Building Services Piping										
15107620 - Pipe, Steel										
0630	Pipe, steel, black, threaded, 3" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC	116.0	LF	32.51	19.50				52.01	6,033
Building Services Piping Total										6,033
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0010	Duct, FRP, 10" dia.	200.0	lnft	91.90	19.00				110.90	22,180
B0020	Duct, FRP, 20" dia.	260.0	lnft	119.47	48.00				167.47	43,542
B0028	Duct, FRP, 28" dia.	155.0	lnft	147.04	65.00				212.04	32,866
B0036	Duct, FRP, 36" dia.	15.0	lnft	174.61	83.00				257.61	3,864
B10E	Fitting, FRP, 90 Elbow, 10" dia.	10.0	ea	459.50	89.00				548.50	5,485
B20E	Fitting, FRP, 90 Elbow, 20" dia.	1.0	ea	808.72	324.00				1,132.72	1,133
B20T	Pipe, fitting, fbgl., 20" Tee	6.0	ea	533.88	218.51				752.39	4,514
B28T	Pipe, fitting, fbgl., 28" Tee	1.0	ea	753.58	262.57				1,016.15	1,016
B30R	Pipe, fitting, fbgl., 30" x 28" Reducer	1.0	ea	1,148.75	392.59				1,541.34	1,541
B36V	36" FRP Dampers, volume control	2.0	ea	245.10	1,200.00				1,445.10	2,890
Process Piping Total										119,032

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
15700 - Heating/Ventilating/Air Conditioning Equipment										
15700200 - Fans										
0080	Fans, supply, 9,000 scfm, frp construction	1.0	each	2,364.12	20,000.00				22,364.12	22,364
Heating/Ventilating/Air Conditioning Equipment Total										22,364
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork / Balancing, air conditioning equipment, supply, return, exhaust, registers and diffusers, floor height, (Subcontractor's quote including material & labor)	8.0	EA			59.00			59.00	472
Testing/Adjusting/Balancing Total										472

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
D1B - Cover & Treat Aeration Basins (Engineered Media)									1,417,413	
03100 - Concrete Forms & Accessories										
03110425 - Forms In Place, Equipment Foundations										
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	52.7	sfca	20.07	1.70				21.77	1,147
03110445 - Forms In Place, Slab On Grade										
3550	C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	36.0	LF	13.94	0.80				14.74	530
Concrete Forms & Accessories Total									1,677	
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	449.5	lb	0.64	0.50				1.14	514
2000	Reinforcing steel, unload and sort, add to base	0.4	ton	48.77			6.98		55.75	22
2210	Reinforcing steel, crane cost for handling, average, add	0.4	ton	52.32			7.56		59.87	24
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	35.7	EA	3.10	1.15				4.25	151
2450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add	262.6	lb	1.86	0.55				2.41	633
Concrete Reinforcement Total									1,345	
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	2.5	CY		102.00				102.00	254

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
03310700 - Placing Concrete										
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	2.5	CY	22.29			4.17		26.46	66
03350300 - Finishing Floors										
0150	Concrete finishing, floors, basic finishing for unspecified flatwork, bull float, manual float & broom finish, includes edging and joints, excludes placing, striking off & consolidating	36.0	SF	0.87					0.87	31
03350350 - Finishing Walls										
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	52.7	SF	3.25					3.25	171
0750	Concrete finishing, walls, sandblast, heavy penetration	13.4	SF	6.06	1.49		0.56		8.11	108
Cast-In-Place Concrete Total										632
05050 - Basic Metal Materials & Methods										
05090340 - Drilling										
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	232.0	EA	13.12	0.05				13.17	3,056
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	35.7	EA	13.67	0.08				13.75	490
05090380 - Expansion Anchors										
8150	Wedge anchor, carbon steel, 3/8" dia x 2-1/4" L, in concrete, brick or stone, excl layout & drilling	232.0	EA	4.52	0.51				5.03	1,167
05090540 - Machinery Anchors										
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	68.0	EA	71.08	104.00		6.08		181.16	12,319
05090900 - Welding Structural										
2010	Welding structural steel in field, 4 passes, 0.7 Lb/LF, 1/2" thick, continuous fillet, type 6011	222.7	LF	33.76	1.52		5.53		40.80	9,086

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
Basic Metal Materials & Methods Total										26,117
05100 - Structural Metal Framing										
05120560 - Plates										
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	167.0	SF		19.90				19.90	3,323
Structural Metal Framing Total										3,323
06500 - Structural Plastics										
06520175 - Floor Grating, Fiberglass										
0100	Aluminum Floor Planking, with framing	13,500.0	SF	7.71	53.33		0.37		61.41	829,010
Structural Plastics Total										829,010
11000 - Equipment										
11000100 - Process Equipment										
0010	Engineered Media (hand spread)	18,080.0	cuft	0.95	9.40		0.27		10.63	192,108
Equipment Total										192,108
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing fans	3.0	each	328.01	25,200.00				25,528.01	76,584
Sound, Vibration & Seismic Control Total										76,584
15050 - Basic Materials & Methods										
15050010 - Miscellaneous Mechanical										
0260	piping, connect to existing 10 inch	8.0	each	317.35	40.67		3.98		362.00	2,896
0260	piping, connect to existing 36 inch	2.0	each	1,293.95	165.83		16.23		1,476.00	2,952
0430	piping, cut-in, 36", existing line	1.0	each	2,398.59					2,398.59	2,399
15060300 - Pipe Hangers And Supports										

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
3390	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 10" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	16.0	EA	14.74	242.00				256.74	4,108
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 28" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	46.0	EA	157.99	2,589.00				2,746.99	126,361
Basic Materials & Methods Total										138,716
15100 - Building Services Piping										
15107620 - Pipe, Steel										
0630	Pipe, steel, black, threaded, 3" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC	116.0	LF	32.51	19.50				52.01	6,033
Building Services Piping Total										6,033
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0010	Duct, FRP, 10" dia.	200.0	lnft	91.90	19.00				110.90	22,180
B0020	Duct, FRP, 20" dia.	260.0	lnft	119.47	48.00				167.47	43,542
B0028	Duct, FRP, 28" dia.	155.0	lnft	147.04	65.00				212.04	32,866
B0036	Duct, FRP, 36" dia.	15.0	lnft	174.61	83.00				257.61	3,864
B10E	Fitting, FRP, 90 Elbow, 10" dia.	10.0	ea	459.50	89.00				548.50	5,485
B20E	Fitting, FRP, 90 Elbow, 20" dia.	1.0	ea	808.72	324.00				1,132.72	1,133
B20T	Pipe, fitting, fbgl., 20" Tee	6.0	ea	533.88	218.51				752.39	4,514
B28T	Pipe, fitting, fbgl., 28" Tee	1.0	ea	753.58	262.57				1,016.15	1,016
B30R	Pipe, fitting, fbgl., 30" x 28" Reducer	1.0	ea	1,148.75	392.59				1,541.34	1,541
B36V	36" FRP Dampers, volume control	2.0	ea	245.10	1,200.00				1,445.10	2,890
Process Piping Total										119,032

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
15700 - Heating/Ventilating/Air Conditioning Equipment										
15700200 - Fans										
0080	Fans, supply, 9,000 scfm, frp construction	1.0	each	2,364.12	20,000.00				22,364.12	22,364
Heating/Ventilating/Air Conditioning Equipment Total										22,364
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork / Balancing, air conditioning equipment, supply, return, exhaust, registers and diffusers, floor height, (Subcontractor's quote including material & labor)	8.0	EA			59.00			59.00	472
Testing/Adjusting/Balancing Total										472

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
D2 - Cover & Treat Secondary Clarifiers									1,992,300	
02300 - Earthwork										
02315120 - Backfill, Structural										
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul, from existing stockpile, excludes compaction	520.6	L.C.Y.	1.27			1.69		2.96	1,539
02315310 - Compaction, General										
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	468.6	E.C.Y.	2.22			0.40		2.62	1,228
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	6.5	E.C.Y.	3.33			0.61		3.94	25
02315492 - Hauling										
0009	Loading Trucks, F.E. Loader, 3 C.Y.	86.8	cuyd	0.96			1.13		2.09	182
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	86.8	L.C.Y.	3.49			4.60		8.09	702
02315610 - Excavating, Trench										
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	485.9	B.C.Y.	5.84			1.82		7.66	3,720
Earthwork Total									7,397	
03100 - Concrete Forms & Accessories										
03110425 - Forms In Place, Equipment Foundations										
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	316.0	sfca	20.07	1.70				21.77	6,880
03110430 - Forms In Place, Footings										
5050	C.I.P. concrete forms, footing, spread, plywood, 2 use, includes erecting, bracing, stripping and cleaning	1,277.9	sfca	6.56	1.11				7.67	9,797

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
03110445 - Forms In Place, Slab On Grade										
3550	C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	213.0	LF	13.94	0.80				14.74	3,139
Concrete Forms & Accessories Total										19,816
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	9,954.5	lb	0.64	0.50				1.14	11,380
2000	Reinforcing steel, unload and sort, add to base	5.8	ton	48.77			6.98		55.75	324
2210	Reinforcing steel, crane cost for handling, average, add	5.8	ton	52.32			7.56		59.87	348
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	273.0	EA	3.10	1.15				4.25	1,160
2450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add	1,050.4	lb	1.86	0.55				2.41	2,533
Concrete Reinforcement Total										15,745
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	67.2	CY		102.00				102.00	6,856
03310700 - Placing Concrete										
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	67.2	CY	22.29			4.17		26.46	1,779
03350300 - Finishing Floors										
0150	Concrete finishing, floors, basic finishing for unspecified flatwork, bull float, manual float & broom finish, includes edging and joints, excludes placing, striking off & consolidating	660.0	SF	0.87					0.87	577

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
03350350 - Finishing Walls										
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	857.9	SF	3.25					3.25	2,788
0750	Concrete finishing, walls, sandblast, heavy penetration	149.0	SF	6.06	1.49		0.56		8.11	1,209
Cast-In-Place Concrete Total										13,210
05050 - Basic Metal Materials & Methods										
05090080 - Anchor Bolts										
0130	Anchor bolt, J-type, 2-bolt set, plain steel, 3/4" dia x 8" L, incl nut & washer, job-built 2-hole template	18.0	set	32.71	10.85				43.56	784
0170	Anchor bolt, J-type, 2-bolt set, plain steel, 1" dia x 18" L, incl nut & washer, job-built 2-hole template	18.0	set	34.44	25.50				59.94	1,079
05090340 - Drilling										
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	172.0	EA	13.12	0.05				13.17	2,265
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	273.0	EA	13.67	0.08				13.75	3,753
05090380 - Expansion Anchors										
8150	Wedge anchor, carbon steel, 3/8" dia x 2-1/4" L, in concrete, brick or stone, excl layout & drilling	172.0	EA	4.52	0.51				5.03	865
05090540 - Machinery Anchors										
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	172.0	EA	71.08	104.00		6.08		181.16	31,159
05090900 - Welding Structural										
2010	Welding structural steel in field, 4 passes, 0.7 Lb/LF, 1/2" thick, continuous fillet, type 6011	152.7	LF	33.76	1.52		5.53		40.80	6,229
Basic Metal Materials & Methods Total										46,135
05100 - Structural Metal Framing										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
05120560 - Plates										
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	114.5	SF		19.90				19.90	2,279
Structural Metal Framing Total										2,279
05500 - Metal Fabrications										
05580950 - Miscellaneous Fabrication										
0990bc	Fabricated Pipe Strap	989.9	lb	1.00	0.80		0.03		1.83	1,812
Metal Fabrications Total										1,812
06500 - Structural Plastics										
06520175 - Floor Grating, Fiberglass										
0100	Aluminum Floor Planking, with framing	15,708.0	SF	7.71	60.16		0.37		68.24	1,071,840
Structural Plastics Total										1,071,840
11000 - Equipment										
11000100 - Process Equipment										
1140	Odor control tower, complete w/ media	1.0	each			387,500.00			387,500.00	387,500
Equipment Total										387,500
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ new fan	1.0	each	328.01	28,000.00				28,328.01	28,328
0045DG	Enclosures, sound @ existing fans	2.0	each	328.01	25,200.00				25,528.01	51,056
Sound, Vibration & Seismic Control Total										79,384
15050 - Basic Materials & Methods										
15060300 - Pipe Hangers And Supports										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 16" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	16.0	EA	87.08	1,720.00				1,807.08	28,913
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 24" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	26.0	EA	133.76	2,643.00				2,776.76	72,196
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 36" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	1.0	EA	164.82	3,944.00				4,108.82	4,109
Basic Materials & Methods Total										105,218
15100 - Building Services Piping										
15107620 - Pipe, Steel										
0630	Pipe, steel, black, threaded, 3" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC	86.0	LF	32.51	19.50				52.01	4,472
Building Services Piping Total										4,472
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0016	Duct, FRP, 16" dia.	160.0	lnft	110.28	29.00				139.28	22,285
B0018	Duct, FRP, 18" dia.	400.0	lnft	110.28	38.00				148.28	59,312
B0026	Duct, FRP, 26" dia.	110.0	lnft	141.46	62.54				204.00	22,440
B0038	Duct, FRP, 38" dia.	120.0	lnft	188.43	89.57				278.00	33,360
B16E	Fitting, FRP, 90 Elbow, 16" dia.	12.0	ea	698.44	206.00				904.44	10,853
B18E	Fitting, FRP, 90 Elbow, 18" dia.	2.0	ea	771.96	295.00				1,066.96	2,134
B18T	Pipe, fitting, fbgl., 18" Tee	4.0	ea	482.11	211.21				693.31	2,773
B26E	Fitting, FRP, 90 Elbow, 26" dia.	5.0	ea	1,020.54	490.46				1,511.00	7,555
B26E2	Fitting, FRP, 45 Elbow, 26" dia.	1.0	ea	675.36	300.64				976.00	976

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
B38E	Fitting, FRP, 90 Elbow, 38" dia.	2.0	ea	1,755.68	1,054.31				2,809.99	5,620
B38E2	Fitting, FRP, 45 Elbow, 38" dia.	1.0	ea	1,162.02	634.62				1,796.64	1,797
B38T	Pipe, fitting, fbgl., 38" Tee	4.0	ea	1,035.94	405.05				1,440.99	5,764
Process Piping Total										174,869
15700 - Heating/Ventilating/Air Conditioning Equipment										
15700200 - Fans										
0080	Fans, supply, 15,000 scfm, frp construction	1.0	each	3,152.16	29,000.00				32,152.16	32,152
Heating/Ventilating/Air Conditioning Equipment Total										32,152
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork / Balancing, air conditioning equipment, supply, return, exhaust, registers and diffusers, floor height, (Subcontractor's quote including material & labor)	8.0	EA			59.00			59.00	472
Testing/Adjusting/Balancing Total										472
16000 - Electrical and Instrumentation										
16000000 - Electrical and Instrumentation										
0001	Electrical and Instrumentation Subcontract	1.0	Isum			30,000.00			30,000.00	30,000
Electrical and Instrumentation Total										30,000

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
D3 - Cover & treat Abs and SCs										3,191,660
02300 - Earthwork										
02315120 - Backfill, Structural										
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul, from existing stockpile, excludes compaction	881.6	L.C.Y.	1.27			1.69		2.96	2,607
02315310 - Compaction, General										
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	793.5	E.C.Y.	2.22			0.40		2.62	2,080
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	8.6	E.C.Y.	3.33			0.61		3.94	34
02315492 - Hauling										
0009	Loading Trucks, F.E. Loader, 3 C.Y.	136.4	cuyd	0.96			1.13		2.09	286
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	136.4	L.C.Y.	3.49			4.60		8.09	1,103
02315610 - Excavating, Trench										
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	814.5	B.C.Y.	5.84			1.82		7.66	6,236
Earthwork Total										12,346
02450 - Foundation & Load Bearing Elements										
02455900 - Mobilization										
0500	Mobilization, to 36", set up and remove drill rig, for caissons, minimum	1.0	EA	3,345.05			2,427.95		5,773.00	5,773
02465800 - Drilled Caissons										

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
0300	Fixed end caisson piles, open style in stable ground, to 50' deep, 30" diameter, 0.182 C.Y./L.F., machine drilled, includes excavation, concrete, 50 lb. reinforcing/C.Y., excludes mobilization, boulder removal, disposal, no casings or ground water	40.0	vft	22.18	22.00		16.26		60.44	2,417
Foundation & Load Bearing Elements Total										8,190
03100 - Concrete Forms & Accessories										
03110425 - Forms In Place, Equipment Foundations										
0050	C.I.P. concrete forms, equipment foundations, 2 use, includes erecting, bracing, stripping and cleaning	158.7	sfca	20.07	1.70				21.77	3,455
03110430 - Forms In Place, Footings										
5050	C.I.P. concrete forms, footing, spread, plywood, 2 use, includes erecting, bracing, stripping and cleaning	3,425.5	sfca	6.56	1.11				7.67	26,264
03110445 - Forms In Place, Slab On Grade										
3550	C.I.P. concrete forms, slab on grade, depressed, edge, wood, 12" to 24" high, 4 use, includes erecting, bracing, stripping and cleaning	246.0	LF	13.94	0.80				14.74	3,625
Concrete Forms & Accessories Total										33,343
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	16,925.7	lb	0.64	0.50				1.14	19,349
2000	Reinforcing steel, unload and sort, add to base	9.4	ton	48.77			6.98		55.75	525
2210	Reinforcing steel, crane cost for handling, average, add	9.4	ton	52.32			7.56		59.87	564
2420	Reinforcing steel, in place, dowels, deformed, 2' long, #5, A615, grade 60	128.7	EA	3.10	1.15				4.25	546
2450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add	1,613.1	lb	1.86	0.55				2.41	3,890
Concrete Reinforcement Total										24,875

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	124.7	CY		102.00				102.00	12,724
03310700 - Placing Concrete										
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	124.7	CY	22.29			4.17		26.46	3,300
03350300 - Finishing Floors										
0150	Concrete finishing, floors, basic finishing for unspecified flatwork, bull float, manual float & broom finish, includes edging and joints, excludes placing, striking off & consolidating	1,261.0	SF	0.87					0.87	1,103
03350350 - Finishing Walls										
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	2,332.9	SF	3.25					3.25	7,583
0750	Concrete finishing, walls, sandblast, heavy penetration	61.7	SF	6.06	1.49		0.56		8.11	501
Cast-In-Place Concrete Total										25,211
05050 - Basic Metal Materials & Methods										
05090080 - Anchor Bolts										
0130	Anchor bolt, J-type, 2-bolt set, plain steel, 3/4" dia x 8" L, incl nut & washer, job-built 2-hole template	86.0	set	32.71	10.85				43.56	3,746
05090340 - Drilling										
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	120.0	EA	13.12	0.05				13.17	1,580
0400	Concrete impact drilling, for anchors, up to 4" D, 5/8" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	128.7	EA	13.67	0.08				13.75	1,769
05090380 - Expansion Anchors										

Clackamas County WES

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
8150	Wedge anchor, carbon steel, 3/8" dia x 2-1/4" L, in concrete, brick or stone, excl layout & drilling	120.0	EA	4.52	0.51				5.03	604
	05090540 - Machinery Anchors									
0800	Machinery anchor, heavy duty, 1" dia stud & bolt, incl sleeve, floating base nut, lower stud & coupling nut, fiber plug, connecting stud, washer & nut	120.0	EA	71.08	104.00		6.08		181.16	21,739
	05090900 - Welding Structural									
2010	Welding structural steel in field, 4 passes, 0.7 Lb/LF, 1/2" thick, continuous fillet, type 6011	82.0	LF	33.76	1.52		5.53		40.80	3,346
	Basic Metal Materials & Methods Total									32,784
	05100 - Structural Metal Framing									
	05120560 - Plates									
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	61.5	SF		19.90				19.90	1,224
	Structural Metal Framing Total									1,224
	05500 - Metal Fabrications									
	05580950 - Miscellaneous Fabrication									
0990bc	Fabricated Pipe Strap	1,426.5	lb	1.00	0.80		0.03		1.83	2,611
	Metal Fabrications Total									2,611
	06500 - Structural Plastics									
	06520175 - Floor Grating, Fiberglass									
0100	Aluminum Floor Planking, with framing	29,208.0	SF	7.71	57.00		0.37		65.08	1,900,850
	Structural Plastics Total									1,900,850
	11000 - Equipment									
	11000100 - Process Equipment									
1140	Odor control tower, complete w/ media	2.0	each			310,000.00			310,000.00	620,000

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
Equipment Total									620,000	
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing and new fans	4.0	each	328.01	25,200.00				25,528.01	102,112
Sound, Vibration & Seismic Control Total									102,112	
15050 - Basic Materials & Methods										
15060300 - Pipe Hangers And Supports										
3390	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 10" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	14.0	EA	14.74	242.00				256.74	3,594
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 20" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	12.0	EA	109.41	2,161.00				2,270.41	27,245
Basic Materials & Methods Total									30,839	
15100 - Building Services Piping										
15107620 - Pipe, Steel										
0630	Pipe, steel, black, threaded, 3" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC	60.0	LF	32.51	19.50				52.01	3,120
Building Services Piping Total									3,120	
15200 - Process Piping										
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0010	Duct, FRP, 10" dia.	200.0	lnft	91.90	19.00				110.90	22,180
B0020	Duct, FRP, 20" dia.	260.0	lnft	119.47	48.00				167.47	43,542
B0024	Duct, FRP, 24" dia.	400.0	lnft	137.85	59.00				196.85	78,740
B0028	Duct, FRP, 28" dia.	210.0	lnft	147.04	65.00				212.04	44,528

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
B0042	Duct, FRP, 42" dia.	50.0	lnft	202.18	106.00				308.18	15,409
B0048	Duct, FRP, 48" dia.	80.0	lnft	229.75	124.00				353.75	28,300
B10E	Fitting, FRP, 90 Elbow, 10" dia.	9.0	ea	459.50	89.00				548.50	4,937
B16E	Fitting, FRP, 90 Elbow, 16" dia.	12.0	ea	698.44	206.00				904.44	10,853
B20T	Pipe, fitting, fbgl., 20" Tee	4.0	ea	533.88	218.51				752.39	3,010
B24E	Fitting, FRP, 90 Elbow, 24" dia.	2.0	ea	919.00	471.00				1,390.00	2,780
B24T	Pipe, fitting, fbgl., 24" Tee	4.0	ea	637.42	233.11				870.53	3,482
B36E	Fitting, FRP, 90 Elbow, 36" dia.	5.0	ea	1,470.40	883.00				2,353.40	11,767
B36E2	Fitting, FRP, 45 Elbow, 36" dia.	1.0	ea	970.46	530.00				1,500.46	1,500
B36T	Pipe, fitting, fbgl., 36" Tee	2.0	ea	972.30	380.17				1,352.47	2,705
B42T	Pipe, fitting, fbgl., 42" Tee	7.0	ea	1,137.72	481.31				1,619.03	11,333
B48E	Fitting, FRP, 90 Elbow, 48" dia.	2.0	ea	2,021.80	2,353.00				4,374.80	8,750
B48T	Pipe, fitting, fbgl., 48" Tee	4.0	ea	1,303.14	593.54				1,896.68	7,587
15200065 - Pipe, Black Steel Welded										
0250	Piping, water dist, factory coated steel, pl end, welded, 1/2" wall, 36" dia (bridge casing)	30.0	lnft	148.12	177.00		64.66		389.77	11,693
15200300 - Expansion Couplings										
0030	Pipe, steel ftngs, flg cplg adapter, 28" (bridge)	2.0	each	1,299.72	204.83				1,504.55	3,009
Process Piping Total										316,105
15700 - Heating/Ventilating/Air Conditioning Equipment										
15700200 - Fans										
0080	Fans, supply, 12,000 scfm, frp construction	2.0	each	3,152.16	20,400.00				23,552.16	47,104
Heating/Ventilating/Air Conditioning Equipment Total										47,104

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
15950 - Testing/Adjusting/Balancing										
15955100 - Balancing, Air										
3200	Leak Test, ductwork / Balancing, air conditioning equipment, supply, return, exhaust, registers and diffusers, floor height, (Subcontractor's quote including material & labor)	16.0	EA			59.00			59.00	944
Testing/Adjusting/Balancing Total										944
16000 - Electrical and Instrumentation										
16000000 - Electrical and Instrumentation										
0001	Electrical and Instrumentation Subcontract	1.0	Isum			30,000.00			30,000.00	30,000
Electrical and Instrumentation Total										30,000

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
E - Cover Biofilters to Improve Dispersion										1,082,412
01590 - Construction Aids										
01590400 - General equipment rental without operators										
7030B	Rent trench box, 3000 lbs 6' x 6' - Rent per day	72.0	days				84.50		84.50	6,084
Construction Aids Total										6,084
02300 - Earthwork										
02315462 - Excavation, Structural										
0015	Structural excavation for minor structures, bank measure, biofilter media, pits to 6' deep, hand	48.0	B.C.Y.	58.62					58.62	2,814
Earthwork Total										2,814
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing fans	2.0	each	328.01	25,200.00				25,528.01	51,056
Sound, Vibration & Seismic Control Total										51,056
13120 - Pre-Engineered Structures										
13128160 - Tension Structures										
0410	Tension structure, rigid steel/alum. frame, vinyl coated polyester fabric shell, 100' to 119' clear span, 10,000 SF, excl. foundations or floors	11,500.0	SF	9.53	60.87		1.38		71.79	825,541
Pre-Engineered Structures Total										825,541
15200 - Process Piping										
15200200 - Flanges, Steel										
0150	Pipe, st ftngs, gskt & bolt set, 150#, 20" pipe size	18.0	each	319.65	111.00				430.65	7,752

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
0860	Pipe, st ftng, flg, FS, 316 ss, slip-on, 150 LB flg, wld frt&back, 20" pipe	24.0	each	1,599.06	1,451.44		27.66		3,078.16	73,876
	15200212 - Pipe, 316 Stainless Steel									
0600	Pipe, SS, A778, weld, 0.250 wall, type 316L, 20" dia	90.0	lnft	127.47	202.90		3.37		333.73	30,036
	Process Piping Total									111,664
	15700 - Heating/Ventilating/Air Conditioning Equipment									
	15700200 - Fans									
0080	Fans, supply, 4000 scfm, frp construction	6.0	each	708.59	6,000.35				6,708.94	40,254
	Heating/Ventilating/Air Conditioning Equipment Total									40,254
	16000 - Electrical and Instrumentation									
	16000000 - Electrical and Instrumentation									
0001	Electrical and Instrumentation Subcontract	1.0	lsum			45,000.00			45,000.00	45,000
	Electrical and Instrumentation Total									45,000

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
F - Dewatering Addition										2,551,818
01800 - Facility Operation										
01832350 - Mechanical Facilities Maintenance										
3120	Valve, remove and replace, 8"	2.0	EA	540.00					540.00	1,080
Facility Operation Total										1,080
02200 - Site Preparation										
02210200 - Core Drilling										
1700	Concrete core drilling, core, reinforced concrete slab, 18" diameter, up to 6" thick wall, includes bit, layout and set up	2.0	EA	124.19	2.93		12.26		139.38	279
1750	Concrete core drilling, core, reinforced concrete slab, 18" diameter, up to 6" thick wall, includes bit, layout and set up, each added inch thick in same hole, add	12.0	EA	7.78	0.49		0.77		9.03	108
02220330 - Selective Demolition, Dump Charges										
9999	Dump Charge, typical urban city, fees only, bldg constr mat'ls (duct)	0.4	ton					33.00	33.00	13
02220452 - Seletive Demolition - Equipment Dismantling										
0980	Equipment dismantling/demolition, odor control vessel, complete	1.0	Isum	2,205.60			292.71		2,498.31	2,498
Site Preparation Total										2,899
02300 - Earthwork										
02310100 - Finish Grading										
1200	Fine grading, fine grade granular base for sidewalks and bikeways	161.1	SY	1.35			0.13		1.48	239
02315120 - Backfill, Structural										
4420	Backfill, structural, common earth, 200 H.P. dozer, 300' haul, from existing stockpile, excludes compaction	315.7	L.C.Y.	1.27			1.69		2.96	934

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
02315310 - Compaction, General										
7500	Compaction, 2 passes, 24" wide, 6" lifts, walk behind, vibrating roller	284.1	E.C.Y.	2.22			0.40		2.62	745
7520	Compaction, 3 passes, 24" wide, 6" lifts, walk behind, vibrating roller	2.4	E.C.Y.	3.33			0.61		3.94	9
02315462 - Excavation, Structural										
0100	Structural excavation for minor structures, bank measure, heavy soil or clay, pits to 6' deep, by hand	20.0	B.C.Y.	117.25					117.25	2,345
02315492 - Hauling										
0009	Loading Trucks, F.E. Loader, 3 C.Y.	46.0	cuyd	0.96			1.13		2.09	96
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	203.1	L.C.Y.	3.49			4.60		8.09	1,642
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment (odor control vessel)	30.0	L.C.Y.	3.49			4.60		8.09	243
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment	4.0	L.C.Y.	3.49			4.60		8.09	32
9498	Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 25 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 20 miles, 45 MPH, excludes loading equipment (pipe & concrete)	9.0	L.C.Y.	3.49			4.60		8.09	73
02315610 - Excavating, Trench										
0060	Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	289.3	B.C.Y.	5.84			1.82		7.66	2,215
Earthwork Total										8,573
02700 - Bases, Ballasts, Pavements & Appurtenances										

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
02720200 - Aggregate Base Course										
0100	Base course drainage layers, aggregate base course for roadways and large paved areas, stone base, compacted, 3/4" stone base, to 6" deep	161.1	SY	0.64	6.00		0.75		7.39	1,191
6000	Base course drainage layers, for roadways and large paved areas, stabilization fabric, polypropylene, 6 oz./S.Y.	161.1	SY	0.16	1.16		0.04		1.35	218
02740310 - Asphaltic Concrete Pavement, Highways Hot Mix										
1050	Plant-mix asphalt paving, for highways and large paved areas, pavement replacement over trench, 4" thick, no hauling included	161.1	SY	43.51	14.65		2.13		60.30	9,714
Bases, Ballasts, Pavements & Appurtenances Total										11,123
03050 - Basic Concrete Materials & Methods										
03055110 - Selective Concrete Demolition										
0060	Selective concrete demolition, reinf 1% - 2% of cross-sectional area, break up into small pieces, excludes shoring, bracing, saw or torch cutting, loading, hauling, dumping	4.0	CY	149.07			13.09		162.16	649
Basic Concrete Materials & Methods Total										649
03100 - Concrete Forms & Accessories										
03110430 - Forms In Place, Footings										
5050	C.I.P. concrete forms, footing, spread, plywood, 2 use, includes erecting, bracing, stripping and cleaning	504.3	sfca	6.56	1.11				7.67	3,867
Concrete Forms & Accessories Total										3,867
03200 - Concrete Reinforcement										
03210600 - Reinforcing In Place										
0602	Reinforcing Steel, in place, slab on grade, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	745.5	lb	0.64	0.50				1.14	852
2000	Reinforcing steel, unload and sort, add to base	0.4	ton	48.77			6.98		55.75	21
2210	Reinforcing steel, crane cost for handling, average, add	0.4	ton	52.32			7.56		59.87	22

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
Concrete Reinforcement Total										895
03300 - Cast-In-Place Concrete										
03310220 - Concrete, Ready Mix Normal Weight										
0300	Structural concrete, ready mix, normal weight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	7.2	CY		102.00				102.00	737
03310700 - Placing Concrete										
4650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (strike off) & consolidation, excludes material	7.2	CY	22.29			4.17		26.46	191
03350350 - Finishing Walls										
0150	Concrete finishing, walls, carborundum rub, wet, includes breaking ties and patching voids	199.0	SF	3.25					3.25	647
Cast-In-Place Concrete Total										1,575
05050 - Basic Metal Materials & Methods										
05090080 - Anchor Bolts										
0130	Anchor bolt, J-type, 2-bolt set, plain steel, 3/4" dia x 8" L, incl nut & washer, job-built 2-hole template	32.0	set	32.71	10.85				43.56	1,394
05090340 - Drilling										
0300	Concrete impact drilling, for anchors, up to 4" D, 1/2" dia, in concrete or brick walls and floors, incl bit & layout, excl anchor	36.0	EA	13.12	0.05				13.17	474
05090380 - Expansion Anchors										
8150	Wedge anchor, carbon steel, 3/8" dia x 2-1/4" L, in concrete, brick or stone, excl layout & drilling	36.0	EA	4.52	0.51				5.03	181
05090900 - Welding Structural										
2010	Welding structural steel in field, 4 passes, 0.7 Lb/LF, 1/2" thick, continuous fillet, type 6011	38.0	LF	33.76	1.52		5.53		40.80	1,551
Basic Metal Materials & Methods Total										3,600

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
05100 - Structural Metal Framing										
05120560 - Plates										
0300	Steel plate, structural, for connections & stiffeners, 3/8" T, shop fabricated, incl shop primer	28.5	SF		19.90				19.90	567
Structural Metal Framing Total										567
05500 - Metal Fabrications										
05580950 - Miscellaneous Fabrication										
0990bc	Fabricated Pipe Strap	211.1	lb	1.00	0.80		0.03		1.83	386
Metal Fabrications Total										386
08300 - Specialty Doors										
08360550 - Overhead, Commercial										
2650	Doors, overhead, commercial, stock, steel, heavy duty, sectional, chain hoist, 10' x 10' high	2.0	EA	728.91	1,100.00				1,828.91	3,658
2800	Doors, overhead, commercial, stock, steel, heavy duty, sectional, chain hoist, 16' x 16' high	2.0	EA	1,707.69	3,405.63				5,113.32	10,227
2900	Doors, overhead, commercial, stock, steel, heavy duty, sectional, for electric trolley operator, 1/3 HP, to 12' x 12', add	2.0	EA	328.01	925.00				1,253.01	2,506
2950	Doors, overhead, commercial, stock, steel, heavy duty, sectional, for electric trolley operator, 1/2 HP, over 16' x 16', add	2.0	EA	656.02	1,100.00				1,756.02	3,512
Specialty Doors Total										19,903
09900 - Paints & Coatings										
09910641 - B & C Coatings										
0020bc	Coatings & paints, B & C coating system E-2 (Epoxy, metal pipe /equipment)	1,698.0	sqft	1.18	1.11				2.29	3,881
Paints & Coatings Total										3,881
11000 - Equipment										

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
11000100 - Process Equipment										
0300IK	Dewatering Polymer Feed System	1.0	each	5,068.18	41,000.00		1,006.67		47,074.85	47,075
0390	Solids handling, centrifuge,	1.0	each	55,466.19	780,000.00				835,466.19	835,466
1140	Odor control tower, complete w/ media	1.0	each			310,000.00			310,000.00	310,000
1270DS	Pump, rotary lobe type	2.0	each	7,821.89	26,000.00				33,821.89	67,644
1350	Shaftless screw conveyor, 63 ft	1.0	each	7,548.60	91,000.00		999.56		99,548.17	99,548
11000500 - Sluice gates										
0100	Hopper Gates	6.0	each	1,672.53	8,500.05		331.19		10,503.76	63,023
Equipment Total										1,422,756
13080 - Sound, Vibration & Seismic Control										
13081200 - Sound Traps										
0045DG	Enclosures, sound @ existing fans	3.0	each	328.01	25,200.00				25,528.01	76,584
Sound, Vibration & Seismic Control Total										76,584
13130 - Buildings and Structures										
13130300 - Wastewater Treatment Structures										
003	Dewatering Building	3,740.0	SF					150.00	150.00	561,000
003	Maintenance Building	234.0	SF					150.00	150.00	35,100
Buildings and Structures Total										596,100
15050 - Basic Materials & Methods										
15050010 - Miscellaneous Mechanical										
0009	Allowance - Piping, Polymer	1.0	lsum				10,000.00		10,000.00	10,000
0260	piping, connect to existing 20" pipe	3.0	each	2,297.50	294.44		28.81		2,620.75	7,862
0430	piping, cut-in, 8", existing line	1.0	each	533.02					533.02	533

Clackamas County WES

**WWTP Odor Study
CCSD No. 1 Kellogg Facility**

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
15055300 - HVAC Demolition										
1600	Ductwork, fiberglass, prefabricated, selective demolition	60.0	LF	3.57					3.57	214
15060300 - Pipe Hangers And Supports										
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 20" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	5.0	EA	109.41	2,161.00				2,270.41	11,352
3400	Pipe hanger / support, saddle type pipe support, complete, adjustable, cast iron saddle, 32" pipe size, type number 36 per MSS-SP58, excludes vertical pipe riser (usually 3" Diam)	4.0	EA	157.99	2,693.00				2,850.99	11,404
Basic Materials & Methods Total										41,366
15100 - Building Services Piping										
15107620 - Pipe, Steel										
0630	Pipe, steel, black, threaded, 3" diameter, schedule 40, Spec. A-53, includes coupling and clevis hanger assembly sized for covering, 10' OC	18.0	LF	32.51	19.50				52.01	936
15110600 - Valves, Semi-Steel										
7050	Valves, semi-steel, lubricated plug valve, flanged, 200 psi, 8"	2.0	EA	852.83	1,575.00				2,427.83	4,856
Building Services Piping Total										5,792
15200 - Process Piping										
15200032 - Flanges, Ductile Iron										
0090	Stl ftg, gskt & bolt set, 150#, 8" pipe	31.0	each	147.04	14.45				161.49	5,006
1010	Stl ftg, weld-on flg, fst, wldg neck, 150 lb flg, 8" pipe	51.0	each	304.58	74.50		5.27		384.35	19,602
15200045 - Pipe, Fiberglass Reinforced (FRP)										
B0020	Duct, FRP, 20" dia.	60.0	lnft	119.47	48.00				167.47	10,048
	Duct, FRP, 32" dia.	134.0	lnft	180.12	81.86				261.98	35,105
B20E	Fitting, FRP, 90 Elbow, 20" dia.	1.0	ea	808.72	324.00				1,132.72	1,133

Clackamas County WES

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
B30E	Fitting, FRP, 90 Elbow, 32" dia.	4.0	ea	1,388.87	684.73				2,073.60	8,294
B32T	Pipe, fitting, fbgl., 32" Tee	3.0	ea	869.65	312.34				1,181.99	3,546
	15200165 - Pipe, Glass Lined Ductile Iron									
0040	Piping, DI, glass lined, CL 50, 8" dia	135.0	lnft	23.57	55.42		4.59		83.58	11,283
	15200170 - Fittings, Glass Lined Ductile Iron									
0090	Fitting, DI, glass lined, 90 deg ell, 8" dia	8.0	each	223.08	365.00				588.08	4,705
0220	Fitting, DI, glass lined, tee, 8" dia	2.0	each	353.67	472.00				825.67	1,651
	Process Piping Total									100,374
	15700 - Heating/Ventilating/Air Conditioning Equipment									
	15700200 - Fans									
0080	Fans, supply, 11,000 scfm, frp construction	1.0	each	3,152.16	20,000.00				23,152.16	23,152
	Heating/Ventilating/Air Conditioning Equipment Total									23,152
	15950 - Testing/Adjusting/Balancing									
	15955100 - Balancing, Air									
3200	Leak Test, ductwork	1.0	EA			59.00			59.00	59
	15955700 - Piping, Testing									
0320	Pipe testing, nondestructive hydraulic pressure test, isolate, 1 hour hold, 6" to 10" pipe, 0 - 250 L.F.	1.0	EA	139.59					139.59	140
	Testing/Adjusting/Balancing Total									199
	16000 - Electrical and Instrumentation									
	16000000 - Electrical and Instrumentation									
0001	Electrical and Instrumentation Subcontract	1.0	lsum			226,500.00			226,500.00	226,500
	Electrical and Instrumentation Total									226,500

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Item	Item Description	Takeoff Quantity	Unit	Labor \$/Unit	Materials \$/Unit	Subs \$/Unit	Equip \$/Unit	Other \$/Unit	Total \$/Unit	Total Net Cost \$
------	------------------	---------------------	------	------------------	----------------------	-----------------	------------------	------------------	------------------	-------------------------

Grand Total

12,518,260

Clackamas County WES

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Category	Percent	Amount	Hours
--- Base Estimate --- Totals			
Labor	14.79 %	1,851,626	21,888.9
Material	60.76 %	7,606,455	
Subcontractor	16.03 %	2,006,537	
Equipment	0.74 %	92,229	3,242.2
Other	7.68 %	961,413	
User			
Net Costs		12,518,260	
Labor Mark-up	10.00 %	185,163	
Construction Equipment Mark-up	8.00 %	7,378	
Material/Process Equipment Mark-up	8.00 %	608,516	
Subcontractor Mark-up	5.00 %	100,327	
Material Shipping & Handling	2.00 %	68,217	
Subtotal		13,487,862	
Contractor General Conditions	10.00 %	1,348,786	
Subtotal		14,836,648	
Start-up, training, O & M	2.00 %	82,543	
Subtotal		14,919,191	
Construction Contingency	35.00 %	5,221,717	
Subtotal		20,140,908	
Bldg Risk, Liability Auto Ins.	2.00 %	402,818	
Subtotal		20,543,726	

WWTP Odor Study
CCSD No. 1 Kellogg Facility

Category	Percent	Amount	Hours
Bonds	1.50 %	308,156	
Subtotal		20,851,882	
Escalation to Midpoint	2.50 %	521,297	
Subtotal		21,373,179	
Total --- Base Estimate ---		21,373,179	

Appendix D: Life-Cycle Cost Analysis

**Water Environment Services
Kellogg Creek Odor Analysis
Alternatives Net Present Value Analysis**

Agency: Water Environment Services		Sensitivity Adjustments (%)			Results		
Project/Problem:	Kellogg Creek Odor Analysis	Risk Premium	Benefits	Capital Costs	Other Costs	Capital Cost	20-year NPV
Alternative B	Scum Pit Ventilation Improvements						\$254,000
Alternative C	Enclose Biosolids Loadout Facility						\$1,892,000
Alternative D1	Cover and Treat Aeration Basins						\$2,783,000
Alternative D1.B	Cover and Treat Aeration Basins, Odor Control with Engineered Media						\$2,733,000
Alternative D2	Cover and Treat Secondary Clarifiers						\$3,584,000
Alternative D3	Cover and Treat ABs and SCs						\$5,663,000
Alternative E	Cover Biofilters and Improve Dispersion						\$1,982,000
Alternative F	Dewater and Reduce Trucking						(\$3,925,000)
Alternative F2	Dewater and Reduce Trucking (without savings)						\$5,432,000

Year of analysis: 2013
 Escalation rate: 2.00%
 Discount rate: 4.00%

Select one _____

All entries in dollars

All entries in thousands of dollars

Note: "Status quo" refers to Alternative 1

Make entries in yellow cells only

Water Environment Services - Kellogg Creek Alternative Assumptions			
Alternatives	Value	Source	Notes/ Questions
Common Assumptions for all Alternatives			
Operator II Labor Rate in 2013 (\$/hr)	46.94	Greg Geist, WES WQ Manager	
Odor Control Tower Media Cost of Replacement (\$/replacement)	61,080	Mark Smith Conversation with Vendor	Tower media to be replaced once every 15 years
Odor Control Tower Nutrient Costs (\$/tower-yr)	167	Mark Smith Conversation with Vendor	
Biofilter Media Replacement Costs (\$/cuyd)	83	Mark Smith Conversation with Vendor	Note the quantity of media for replacement is 550 cu yds; Cost includes material and installation
Electrical Power Cost (\$/kwhr)	0.07149	Faye Lindroos, WES	
Conversion Factor: 1 KW to 1.341 BHP	1.34		
Water Cost (\$/gal)	0.00460	Faye Lindroos, WES	
Annual Gallons per cubic yard of biofilter media (gal/cuyd)	311	Doug Rumpel, WES	Biofilters are irrigated 6 months per year and use 90,000 gallons per month for all 6 biofilters;
Annual Gallons per cubic yard of engineered media (gal/cuyd)	386	Darrell Buhman Conversation with Vendor	Biofilters are irrigated 6 months per year
Alternative A - Interlocking Odor Fans			
Capital Cost (\$)	10,000	BC Engineering Team	The existing odor fan will need to be replaced in 10 years, however, replacement of the fan will not be due to this alternative.
Electrical Componentry Replacement Costs	0.00	M.Maisonville	Assumed negligible
Alternative B - Scum Pit Ventilation Improvements			
Capital Cost (\$)	241,552	BC Cost Estimate, 11/05/2013	
Labor to Open Scum Pits (hrs)	9	Doug Rumpel, WES	The scum pits are opened 1x per week. We assumed 10 minutes to adjust the dampers each time which result in 9 hours/yr
Alternative C - Enclose Biosolids Loadout Facility			
Capital Cost (\$)	1,433,092	BC Cost Estimate, 11/05/2013	
Labor for O&M of Odor Control System (hrs)	52	Mark Smith Conversation with Vendor	Assumed 1 hour/wk per odor control tower
Labor for O&M of Blower (hrs)	24	BC Engineering Team	2 hours per month per blower; assumes one blower
Electrical Costs for Building Lights (\$)	2,505	M. Maisonville	6 banks with two bulbs per bank at 1000 watts per bulb; running 8 hours per day at 365 days per year
Electrical Costs Associated with Blowers & Nutrient Pump(\$)	16,812	Mark Smith Conversation with Vendor	One 11K cfm fan @ 32.8BHP; One nutrient recirculation pump per odor tower @ 3.2 BHP
Odor Control Tower Media Replacement Costs (\$)	61,080	Mark Smith Conversation with Vendor	One Tower; Assumed replaced after 15 years
Odor Control Tower Nutrient Costs (\$/yr)	167	Mark Smith Conversation with Vendor	
Alternative D1 - Cover and Treat Aeration Basins			
Capital Cost (\$)	2,206,735	BC Cost Estimate, 11/05/2013	The capital cost has been increased to incorporate a larger fan cost than that listed in the BC Cost Estimate
Labor for O&M of Aluminum Covers (hrs)	24	BC Engineering Team	2 hours per month
Labor for O&M of Blower (hrs)	24	BC Engineering Team	2 hours per month per blower; assumes one blower
Electrical Costs Associated with Blowers & Irrigation Pump(\$)	21,342	Darrell Buhman	One 15K cfm fan = @ 42.7 BHP; One irrigation pump @ 10 hp with lower gpm resulting in BHP of ~3
Biofilter Media Replacement Costs (\$)	45,650	Mark Smith	Assumed replaced after 5 years; 550 cu yards of media; Includes materials and installation
Biofilter Irrigation Water Costs (\$)	787	BC Engineering Team	
Alternative D1.B - Cover and Treat Aeration Basins With Enduro Media			
Capital Cost (\$)	2,448,258	BC Cost Estimate, 11/05/2013	
Labor for O&M of Aluminum Covers (hrs)	24	BC Engineering Team	2 hours per month
Labor for O&M of Blower (hrs)	24	BC Engineering Team	2 hours per month per blower; assumes one blower
Electrical Costs Associated with Blowers & Irrigation Pump(\$)	4,693	Darrell Buhman	One 9K cfm fan = @ 23.5 BHP at 30% runtime; One irrigation pump @ 10 hp with lower gpm resulting in BHP of ~3
Engineered Media Replacement Costs (\$)	192,290	Mark Smith/ Darrell Buhman	Assumed replaced after 15 years
Engineered Media Irrigation Water Costs (\$)	1,191	BC Engineering Team	
Alternative D2 - Cover and Treat Secondary Clarifiers			
Capital Cost (\$)	3,398,254	BC Cost Estimate, 11/05/2013	
Labor for O&M of Odor Control System (hrs)	52	Mark Smith Conversation with Vendor	Assumed 1 hour/wk per odor control tower, in this case there is one tower with 25% more capacity than the tower in Alt C
Labor for O&M of Aluminum Covers (hrs)	24	BC Engineering Team	2 hours per month
Labor for O&M of Blower (hrs)	24	BC Engineering Team	2 hours per month per blower, one blower in this scenario
Electrical Costs Associated with Blowers & Nutrient Pump(\$)	21,809	Mark Smith Conversation with Vendor	One 15K cfm fans @ 42.7 BHP; One nutrient recirc pump @ 3.2 BHP
Odor Control Tower Media Replacement Costs	76,350	Mark Smith Conversation with Vendor	One Tower with 25% more capacity than the single tower costs listed above; Assumed replaced after 15 years
Odor Control Tower Nutrient Costs (\$/yr)	209	Mark Smith Conversation with Vendor	Assume uses 25% more nutrients than the smaller tower listed in Alt C
Alternative D3 - Cover and Treat ABs and SCs			
Capital Cost (\$)	5,436,053	BC Cost Estimate, 11/05/2013	
Labor for O&M of Odor Control System (hrs)	104	Mark Smith Conversation with Vendor	Assumed 1 hour/wk per odor control tower, in this case there are two towers
Labor for O&M of Aluminum Covers (hrs)	48	BC Engineering Team	2 hours per month for the aeration basins and 2 hours per month for the secondary clarifiers
Labor for O&M of Blower (hrs)	48	BC Engineering Team	2 hours per month per blower; in this case there are two blowers
Electrical Costs Associated with Blowers & Nutrient Pump(\$)	33,624	Mark Smith Conversation with Vendor	Two 12K cfm fans @ 32.8 BHP each; 2 nutrient recirc pumps @ 3.2 BHP each
Odor Control Tower Media Replacement Costs	122,160	Mark Smith Conversation with Vendor	Two Towers; Each assumed replaced after 15 years
Odor Control Tower Nutrient Costs (\$/yr)	334	Mark Smith Conversation with Vendor	
Alternative E - Cover Biofilters to Improve Dispersion			
Capital Cost (\$)	1,901,203	BC Cost Estimate, 11/05/2013	
Labor for O&M of Fans (hrs)	144	BC Engineering Team	2 hours per month per fan; total of six fans
Electrical Costs Associated with Biocell Fans (\$)	28,020	Mark Smith Conversation with Vendor	6 fans @ 10 BHP each
Replacement cost for biocell fans (\$/6 fans)	6,710	BC Cost Estimate, 11/05/2013	Replace at year 19
Alternative F - Dewatering Building and Reduced Trucking			
Capital Cost (\$)	4,325,262	BC Cost Estimate, 11/05/2013	
Labor for O&M of Centrifuge (hrs/yr)	0	AapSCO	Assumed 1 hour per day for startup and 15 minutes/day for shutdown during a 5 day work week = \$325/yr; this cost included in calculation for savings. These costs were captured by WES staff in estimated Savings Due to Reduced Haul.
Labor for O&M of Conveyor (hrs/yr)	26	BC Engineering Team	Replace gearbox oil once per year at 2 hours per replacement and 2 hours per month maintenance
Labor for O&M of Polymer System and Tote Delivery (hrs/yr)	0	BC Engineering Team	Totes are delivered once a week, 0.5 hours per delivery = 26 hours per year; this cost included in calculations for savings. These costs were captured by WES staff in estimated Savings Due to Reduced Haul.
Labor for O&M of Blower (hrs)	24	BC Engineering Team	2 hours per month per blower; in this case there is one blower
Labor for O&M of Odor Control System (hrs)	52		Assumed 1 hour/wk per odor control tower, in this case there is one tower
Electrical Cost Associated with Centrifuge (\$)	0		One Centrifuge pump @ 8.3 BHP; Centrifuge main and secondary motors are 300 HP total, assumes operation of 360 min/day = \$24,634/yr; this cost included in calculation for savings. These costs were captured by WES staff in estimated Savings Due to Reduced Haul.
Electrical Cost Associated with Conveyor (\$)	599		One Drive @ 7.5 HP; assumes same operation time as the centrifuge
Electrical Cost Associated with Polymer (\$)	0		One Pump @ 0.5 HP = \$40/yr; this cost included in calculations for savings. These costs were captured by WES staff in estimated Savings Due to Reduced Haul.
Electrical Cost Associated with Building Lighting (\$)	5,010	Marc Maisonville	Assume double the electrical cost of Alt C due to similar footprint but the addition of the second story in the bldg
Electrical Cost Associated with Blowers & Nutrient Pump (\$)	16,812		One 11K cfm fan @ 32.8BHP; One nutrient recirculation pump per odor tower @ 3.2 BHP
Odor Control Tower Media Replacement Costs (\$)	61,080	Mark Smith Conversation with Vendor	One Tower; Assumed replaced after 15 years
Odor Control Tower Nutrient Costs (\$/yr)	167	Mark Smith Conversation with Vendor	
Replacement costs for Centrifuge	**see centrifuge tab		
Replacement costs for Conveyor (\$/replacement)	6300		Liner costs \$400/4ft section of liner, conveyor is 63' in length, replacement interval is every 5 years
Replacement costs for Polymer System (\$/replacement)	0	AapSCO	None needed
Savings Due to Reduced Haul (\$/yr)	511,000	Robert Moon, WES	
Alternative G - Cover the Entire Treatment Plant			
Capital Cost (\$)	22,400,000	Vendor	Cost of a dome that covers the plant; includes installation
Cost for odor system upgrades for all process units (\$)	5,400,000		
HVAC and Lighting (\$)	7,000,000		
Present Worth Evaluation			
Economic Parameters			
Present Worth Term, years	20	Project scope	
Interest rate, %	4%	WES input	Based on WES Borrowing Rate
Inflation rate, %	2%	WES input	
Annual Increase in Salary, %	4%	Greg Geist, WES WQ Manager	The calculation tab compounds this value so we decreased the percentage used accordingly to 3.96%

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative B - Scum Pit Ventilation Improvements**

Operator Salary Escalation

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative B Capital Costs
Odor Control Tower Media Replacement
Total benefits

241,552																					
241,552																					

Annual Running Costs:

Labor to Open Scum Pits
Total running costs

407	415	423	431	440	448	457	466	475	484	494	504	514	524	534	544	555	566	577	588	600
407	415	423	431	440	448	457	466	475	484	494	504	514	524	534	544	555	566	577	588	600

Net Benefit/(cost)

(241,959)	(415)	(423)	(431)	(440)	(448)	(457)	(466)	(475)	(484)	(494)	(504)	(514)	(524)	(534)	(544)	(555)	(566)	(577)	(588)	(600)
-----------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

Alternative B Capital Costs
Total benefits

241,552																					
241,552																					

Annual Running Costs:

Labor to Open Scum Pits
Total running costs

407	423	440	458	476	495	515	535	557	579	602	626	651	677	704	733	762	792	824	857	891
407	423	440	458	476	495	515	535	557	579	602	626	651	677	704	733	762	792	824	857	891

Net escalated benefit/(cost)

(242,000)						(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)	(1,000)
-----------	--	--	--	--	--	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

Cumulative escalated benefit/(cost)

Cumulative Total

\$242,000	\$242,000	\$242,000	\$242,000	\$242,000	\$242,000	\$243,000	\$244,000	\$245,000	\$246,000	\$247,000	\$248,000	\$249,000	\$250,000	\$251,000	\$252,000	\$253,000	\$254,000	\$255,000	\$256,000	\$257,000
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

Life cycle cost analysis

PVs in 2013

\$242,000						\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000			
-----------	--	--	--	--	--	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--	--	--

Cumulative PV

NPV as of 2013

\$242,000	\$242,000	\$242,000	\$242,000	\$242,000	\$242,000	\$243,000	\$244,000	\$245,000	\$246,000	\$247,000	\$248,000	\$249,000	\$250,000	\$251,000	\$252,000	\$253,000	\$254,000	\$254,000	\$254,000	\$254,000	\$254,000
254,000																					

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

2013	Risk adjustments (+/- percent):	
2.00%	Benefits	
4.00%	Capital costs	
	Running costs	

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative C - Enclose Biosolids Loadout Facility**

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative C Capital Costs	1,433,092																				
Odor Control Tower Media Replacement																	61,080				
Total benefits	1,433,092																61,080				

Annual Running Costs:

Labor for O&M of Odor Control System	2,441	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
Labor for O&M of Blowers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Electrical Cost for Building Lighting	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505
Electrical Cost for Blowers & Nutrient Pump	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Odor Control Tower Nutrient Costs	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167
Total running costs	23,052	23,122	23,193	23,265	23,340	23,415	23,492	23,571	23,651	23,733	23,816	23,901	23,987	24,076	24,166	24,257	24,351	24,446	24,543	24,643	24,744

Net Benefit/(cost)	(1,456,144)	(23,122)	(23,193)	(23,265)	(23,340)	(23,415)	(23,492)	(23,571)	(23,651)	(23,733)	(23,816)	(23,901)	(23,987)	(24,076)	(24,166)	(85,337)	(24,351)	(24,446)	(24,543)	(24,643)	(24,744)
---------------------------	--------------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Alternative C Capital Costs	1,433,092																				
Odor Control Tower Media Replacement																	82,206				
Total benefits	1,433,092																82,206				

Annual Running Costs:

Labor for O&M of Odor Control System	2,441	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
Labor for O&M of Blowers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Electrical Cost for Building Lighting	2,505	2,555	2,606	2,658	2,712	2,766	2,821	2,877	2,935	2,994	3,054	3,115	3,177	3,240	3,305	3,371	3,439	3,508	3,578	3,649	3,722
Electrical Cost for Blowers & Nutrient Pump	16,812	17,148	17,491	17,841	18,198	18,562	18,933	19,312	19,698	20,092	20,494	20,904	21,322	21,748	22,183	22,627	23,079	23,541	24,012	24,492	24,982
Odor Control Tower Nutrient Costs	167	170	174	177	181	184	188	192	196	200	204	208	212	216	220	225	229	234	239	243	248
Total running costs	23,052	23,584	24,130	24,690	25,264	25,852	26,456	27,075	27,711	28,363	29,031	29,718	30,422	31,144	31,886	32,647	33,428	34,231	35,054	35,900	36,768

Net escalated benefit/(cost)	(1,456,000)	(24,000)	(24,000)	(25,000)	(25,000)	(26,000)	(26,000)	(27,000)	(28,000)	(28,000)	(29,000)	(30,000)	(30,000)	(31,000)	(32,000)	(115,000)	(33,000)	(34,000)	(35,000)	(36,000)	(37,000)
-------------------------------------	--------------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	------------------	-----------------	-----------------	-----------------	-----------------	-----------------

Cumulative escalated benefit/(cost)

Cumulative Total	\$1,456,000	\$1,480,000	\$1,504,000	\$1,529,000	\$1,554,000	\$1,580,000	\$1,606,000	\$1,633,000	\$1,661,000	\$1,689,000	\$1,718,000	\$1,748,000	\$1,778,000	\$1,809,000	\$1,841,000	\$1,956,000	\$1,989,000	\$2,023,000	\$2,058,000	\$2,094,000	\$2,131,000
------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013	\$1,456,000	\$23,000	\$22,000	\$22,000	\$21,000	\$21,000	\$21,000	\$21,000	\$20,000	\$20,000	\$20,000	\$19,000	\$19,000	\$19,000	\$18,000	\$64,000	\$18,000	\$17,000	\$17,000	\$17,000	\$17,000
Cumulative PV	\$1,456,000	\$1,479,000	\$1,501,000	\$1,523,000	\$1,544,000	\$1,565,000	\$1,586,000	\$1,607,000	\$1,627,000	\$1,647,000	\$1,667,000	\$1,686,000	\$1,705,000	\$1,724,000	\$1,742,000	\$1,806,000	\$1,824,000	\$1,841,000	\$1,858,000	\$1,875,000	\$1,892,000
NPV as of 2013	1,892,000																				

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative D1 - Cover and Treat Aeration Basins**

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative D1 Capital Costs	2,206,735																				
Biofilter Media Replacement Costs						45,650					45,650					45,650					45,650
Total benefits	2,206,735					45,650					45,650					45,650					45,650

Annual Running Costs:

Labor for O&M of Aluminum Covers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Labor for O&M of Blowers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Electrical Cost For Blower and Water Pump	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342	21,342
Water Cost for Biofilter Irrigation	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787	787
Total running costs	24,382	24,426	24,471	24,517	24,564	24,612	24,660	24,710	24,761	24,812	24,865	24,918	24,973	25,029	25,086	25,144	25,203	25,263	25,324	25,387	25,451

Net Benefit/(cost)	(2,231,117)	(24,426)	(24,471)	(24,517)	(24,564)	(70,262)	(24,660)	(24,710)	(24,761)	(24,812)	(70,515)	(24,918)	(24,973)	(25,029)	(25,086)	(70,794)	(25,203)	(25,263)	(25,324)	(25,387)	(71,101)
---------------------------	-------------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Alternative D1 Capital Costs	2,206,735																				
Biofilter Media Replacement Costs						50,401					55,647					61,439					67,833
Total benefits	2,206,735					50,401					55,647					61,439					67,833

Annual Running Costs:

Labor for O&M of Aluminum Covers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Labor for O&M of Blowers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Electrical Cost For Blower and Water Pump	21,342	21,769	22,204	22,648	23,101	23,563	24,035	24,515	25,006	25,506	26,016	26,536	27,067	27,608	28,160	28,724	29,298	29,884	30,482	31,091	31,713
Water Cost for Biofilter Irrigation	787	803	819	835	852	869	886	904	922	941	959	979	998	1,018	1,038	1,059	1,080	1,102	1,124	1,146	1,169
Total running costs	24,382	24,915	25,460	26,018	26,589	27,173	27,772	28,384	29,011	29,653	30,310	30,983	31,672	32,378	33,100	33,840	34,598	35,374	36,170	36,984	37,819

Net escalated benefit/(cost)	(2,231,000)	(25,000)	(25,000)	(26,000)	(27,000)	(78,000)	(28,000)	(28,000)	(29,000)	(30,000)	(86,000)	(31,000)	(32,000)	(32,000)	(33,000)	(95,000)	(35,000)	(35,000)	(36,000)	(37,000)	(106,000)
-------------------------------------	-------------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	-----------

Cumulative escalated benefit/(cost)

Cumulative Total	\$2,231,000	\$2,256,000	\$2,281,000	\$2,307,000	\$2,334,000	\$2,412,000	\$2,440,000	\$2,468,000	\$2,497,000	\$2,527,000	\$2,613,000	\$2,644,000	\$2,676,000	\$2,708,000	\$2,741,000	\$2,836,000	\$2,871,000	\$2,906,000	\$2,942,000	\$2,979,000	\$3,085,000
------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013	\$2,231,000	\$24,000	\$23,000	\$23,000	\$23,000	\$64,000	\$22,000	\$21,000	\$21,000	\$21,000	\$58,000	\$20,000	\$20,000	\$19,000	\$19,000	\$53,000	\$19,000	\$18,000	\$18,000	\$18,000	\$48,000
Cumulative PV	\$2,231,000	\$2,255,000	\$2,278,000	\$2,301,000	\$2,324,000	\$2,388,000	\$2,410,000	\$2,431,000	\$2,452,000	\$2,473,000	\$2,531,000	\$2,551,000	\$2,571,000	\$2,590,000	\$2,609,000	\$2,662,000	\$2,681,000	\$2,699,000	\$2,717,000	\$2,735,000	\$2,783,000
NPV as of 2013	2,783,000																				

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):	
2013	Benefits
2.00%	Capital costs
4.00%	Running costs

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative D1.B Cover and Treat Aeration Basins, Odor Control with Engineered Media**

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative D1 Capital Costs	2,448,258																				
Engineered Media Replacement Costs																		192,290			
Total benefits	2,448,258																	192,290			

Annual Running Costs:

Labor for O&M of Aluminum Covers	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127
Labor for O&M of Blowers	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127
Electrical Cost Associated with Blower	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693	4,693
Water Cost for Irrigation of Engineered Media	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191	1,191
Total running costs	8,137	6,947	6,947	6,947	6,947	6,947	6,947	6,947	6,947	6,947	8,137	8,137	8,137	8,137	8,137	8,137	8,137	8,137	8,137	8,137	8,137

Net Benefit/(cost)

	(2,456,395)	(6,947)	(6,947)	(6,947)	(6,947)	(6,947)	(6,947)	(6,947)	(6,947)	(6,947)	(8,137)	(8,137)	(8,137)	(8,137)	(8,137)	(200,427)	(8,137)	(8,137)	(8,137)	(8,137)	(8,137)
--	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	-----------	---------	---------	---------	---------	---------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Alternative D1 Capital Costs	2,448,258																				
Engineered Media Replacement Costs																		258,797			
Total benefits	2,448,258																	258,797			

Annual Running Costs:

Labor for O&M of Aluminum Covers	1,127	1,149	1,172	1,196	1,219	1,244	1,269	1,294	1,320	1,346	1,373	1,401	1,429	1,457	1,486	1,516	1,547	1,577	1,609	1,641	1,674
Labor for O&M of Blowers	1,127	1,149	1,172	1,196	1,219	1,244	1,269	1,294	1,320	1,346	1,373	1,401	1,429	1,457	1,486	1,516	1,547	1,577	1,609	1,641	1,674
Electrical Cost Associated with Blower	4,693	4,787	4,883	4,981	5,080	5,182	5,286	5,391	5,499	5,609	5,721	5,836	5,952	6,071	6,193	6,317	6,443	6,572	6,703	6,837	6,974
Water Cost for Irrigation of Engineered Media	1,191	1,214	1,239	1,264	1,289	1,315	1,341	1,368	1,395	1,423	1,451	1,480	1,510	1,540	1,571	1,602	1,634	1,667	1,701	1,735	1,769
Total running costs	8,137	8,300	8,466	8,635	8,808	8,984	9,164	9,347	9,534	9,725	9,919	10,118	10,320	10,526	10,737	10,952	11,171	11,394	11,622	11,854	12,091

Net escalated benefit/(cost)

	(2,456,000)	(8,000)	(8,000)	(9,000)	(9,000)	(9,000)	(9,000)	(9,000)	(10,000)	(10,000)	(10,000)	(10,000)	(10,000)	(11,000)	(11,000)	(270,000)	(11,000)	(11,000)	(12,000)	(12,000)	(12,000)
--	-------------	---------	---------	---------	---------	---------	---------	---------	----------	----------	----------	----------	----------	----------	----------	-----------	----------	----------	----------	----------	----------

Cumulative escalated benefit/(cost)

Cumulative Total	\$2,456,000	\$2,464,000	\$2,472,000	\$2,481,000	\$2,490,000	\$2,499,000	\$2,508,000	\$2,517,000	\$2,527,000	\$2,537,000	\$2,547,000	\$2,557,000	\$2,567,000	\$2,578,000	\$2,589,000	\$2,859,000	\$2,870,000	\$2,881,000	\$2,893,000	\$2,905,000	\$2,917,000
------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013

	\$2,456,000	\$8,000	\$7,000	\$8,000	\$8,000	\$7,000	\$7,000	\$7,000	\$7,000	\$7,000	\$7,000	\$6,000	\$6,000	\$7,000	\$6,000	\$150,000	\$6,000	\$6,000	\$6,000	\$6,000	\$5,000
--	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	-----------	---------	---------	---------	---------	---------

Cumulative PV

	\$2,456,000	\$2,464,000	\$2,471,000	\$2,479,000	\$2,487,000	\$2,494,000	\$2,501,000	\$2,508,000	\$2,515,000	\$2,522,000	\$2,529,000	\$2,535,000	\$2,541,000	\$2,548,000	\$2,554,000	\$2,704,000	\$2,710,000	\$2,716,000	\$2,722,000	\$2,728,000	\$2,733,000
--	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

NPV as of 2013

	2,733,000
--	-----------

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative D2 - Cover and Treat Secondary Clarifiers

Operator Salary Escalation

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative D2 Capital Costs
Odor Control Tower Media Replacement Costs
Total benefits

Alternative D2 Capital Costs	3,398,254																				
Odor Control Tower Media Replacement Costs																	76,350				
Total benefits	3,398,254																76,350				

Annual Running Costs:

Labor for O&M of Odor Control System
Labor for O&M of Aluminum Covers
Labor for O&M of Blowers
Electrical Cost of Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Odor Control System	2,441	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
Labor for O&M of Aluminum Covers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Labor for O&M of Blowers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Electrical Cost of Blowers and Nutrient Pump	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559
Odor Control Tower Nutrient Costs	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209
Total running costs	6,462	6,554	6,648	6,743	6,841	6,940	7,042	7,145	7,250	7,358	7,467	7,579	7,693	7,809	7,928	8,048	8,171	8,297	8,425	8,555	8,688

Net Benefit/(cost)

Net Benefit/(cost)	(3,404,716)	(6,554)	(6,648)	(6,743)	(6,841)	(6,940)	(7,042)	(7,145)	(7,250)	(7,358)	(7,467)	(7,579)	(7,693)	(7,809)	(7,928)	(8,048)	(8,171)	(8,297)	(8,425)	(8,555)	(8,688)
--------------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

Alternative D2 Capital Costs
Odor Control Tower Media Replacement Costs
Total benefits

Alternative D2 Capital Costs	3,398,254																				
Odor Control Tower Media Replacement Costs																	102,757				
Total benefits	3,398,254																102,757				

Annual Running Costs:

Labor for O&M of Odor Control System
Labor for O&M of Aluminum Covers
Labor for O&M of Blowers
Electrical Cost of Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Odor Control System	2,441	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
Labor for O&M of Aluminum Covers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Labor for O&M of Blowers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Electrical Cost of Blowers and Nutrient Pump	1,559	1,590	1,622	1,655	1,688	1,721	1,756	1,791	1,827	1,863	1,901	1,939	1,977	2,017	2,057	2,098	2,140	2,183	2,227	2,271	2,317
Odor Control Tower Nutrient Costs	209	213	217	222	226	230	235	240	245	249	254	260	265	270	275	281	287	292	298	304	310
Total running costs	6,462	6,685	6,916	7,156	7,405	7,663	7,930	8,207	8,495	8,793	9,103	9,424	9,757	10,102	10,460	10,832	11,218	11,618	12,033	12,464	12,911

Net escalated benefit/(cost)

Net escalated benefit/(cost)	(3,405,000)	(7,000)	(7,000)	(7,000)	(7,000)	(8,000)	(8,000)	(8,000)	(8,000)	(9,000)	(9,000)	(9,000)	(10,000)	(10,000)	(10,000)	(114,000)	(11,000)	(12,000)	(12,000)	(12,000)	(13,000)
------------------------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	----------	----------	-----------	----------	----------	----------	----------	----------

Cumulative escalated benefit/(cost)

Cumulative Total

Cumulative Total	\$3,405,000	\$3,412,000	\$3,419,000	\$3,426,000	\$3,433,000	\$3,441,000	\$3,449,000	\$3,457,000	\$3,465,000	\$3,474,000	\$3,483,000	\$3,492,000	\$3,502,000	\$3,512,000	\$3,522,000	\$3,636,000	\$3,647,000	\$3,659,000	\$3,671,000	\$3,683,000	\$3,696,000
------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013

PVs in 2013	\$3,405,000	\$7,000	\$6,000	\$6,000	\$6,000	\$7,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$63,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
-------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	---------	---------	---------	---------	---------

Cumulative PV

NPV as of 2013

Cumulative PV	\$3,405,000	\$3,412,000	\$3,418,000	\$3,424,000	\$3,430,000	\$3,437,000	\$3,443,000	\$3,449,000	\$3,455,000	\$3,461,000	\$3,467,000	\$3,473,000	\$3,479,000	\$3,485,000	\$3,491,000	\$3,554,000	\$3,560,000	\$3,566,000	\$3,572,000	\$3,578,000	\$3,584,000
NPV as of 2013	3,584,000																				

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative D3 - Cover and Treat ABs and SCs

Operator Salary Escalation

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative D3 Capital Costs
Odor Control Tower Media Replacement Costs
Total benefits

Alternative D3 Capital Costs	5,436,053																				
Odor Control Tower Media Replacement Costs																	122,160				
Total benefits	5,436,053																122,160				

Annual Running Costs:

Labor for O&M of Odor Control System
Labor for O&M of Aluminum Covers
Labor for O&M of Blowers
Electrical Cost of Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Odor Control System	4,882	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
Labor for O&M of Aluminum Covers	2,253	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Labor for O&M of Blowers	2,253	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Electrical Cost of Blowers and Nutrient Pump	2,404	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559	1,559
Odor Control Tower Nutrient Costs	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334	334
Total running costs	12,126	6,679	6,773	6,869	6,966	7,066	7,167	7,270	7,376	7,483	7,593	7,704	7,818	7,934	8,053	8,174	8,297	8,422	8,550	8,681	8,814

Net Benefit/(cost)

Net Benefit/(cost)	(5,448,179)	(6,679)	(6,773)	(6,869)	(6,966)	(7,066)	(7,167)	(7,270)	(7,376)	(7,483)	(7,593)	(7,704)	(7,818)	(7,934)	(8,053)	(130,334)	(8,297)	(8,422)	(8,550)	(8,681)	(8,814)
--------------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	-----------	---------	---------	---------	---------	---------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

Alternative D3 Capital Costs
Odor Control Tower Media Replacement Costs
Total benefits

Alternative D3 Capital Costs	5,436,053																				
Odor Control Tower Media Replacement Costs																	164,411				
Total benefits	5,436,053																164,411				

Annual Running Costs:

Labor for O&M of Odor Control System
Labor for O&M of Aluminum Covers
Labor for O&M of Blowers
Electrical Cost of Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Odor Control System	4,882	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
Labor for O&M of Aluminum Covers	2,253	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Labor for O&M of Blowers	2,253	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Electrical Cost of Blowers and Nutrient Pump	2,404	1,590	1,622	1,655	1,688	1,721	1,756	1,791	1,827	1,863	1,901	1,939	1,977	2,017	2,057	2,098	2,140	2,183	2,227	2,271	2,317
Odor Control Tower Nutrient Costs	334	341	347	354	362	369	376	384	391	399	407	415	424	432	441	450	459	468	477	487	496
Total running costs	12,126	6,813	7,047	7,289	7,540	7,801	8,071	8,351	8,642	8,943	9,255	9,579	9,916	10,264	10,626	11,001	11,390	11,793	12,212	12,646	13,097

Net escalated benefit/(cost)

Net escalated benefit/(cost)	(5,448,000)	(7,000)	(7,000)	(7,000)	(8,000)	(8,000)	(8,000)	(8,000)	(9,000)	(9,000)	(9,000)	(10,000)	(10,000)	(10,000)	(11,000)	(175,000)	(11,000)	(12,000)	(12,000)	(13,000)	(13,000)
------------------------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	----------	----------	----------	-----------	----------	----------	----------	----------	----------

Cumulative escalated benefit/(cost)

Cumulative Total

Cumulative Total	\$5,448,000	\$5,455,000	\$5,462,000	\$5,469,000	\$5,477,000	\$5,485,000	\$5,493,000	\$5,501,000	\$5,510,000	\$5,519,000	\$5,528,000	\$5,538,000	\$5,548,000	\$5,558,000	\$5,569,000	\$5,744,000	\$5,755,000	\$5,767,000	\$5,779,000	\$5,792,000	\$5,805,000
------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013

PVs in 2013	\$5,448,000	\$7,000	\$6,000	\$6,000	\$7,000	\$7,000	\$6,000	\$6,000	\$7,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000	\$97,000	\$6,000	\$6,000	\$6,000	\$6,000	\$6,000
-------------	-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	---------	---------	---------	---------	---------

Cumulative PV

NPV as of 2013

Cumulative PV	\$5,448,000	\$5,455,000	\$5,461,000	\$5,467,000	\$5,474,000	\$5,481,000	\$5,487,000	\$5,493,000	\$5,500,000	\$5,506,000	\$5,512,000	\$5,518,000	\$5,524,000	\$5,530,000	\$5,536,000	\$5,633,000	\$5,639,000	\$5,645,000	\$5,651,000	\$5,657,000	\$5,663,000
NPV as of 2013	5,663,000																				

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative E - Cover Biofilters and Improve Dispersion**

Year

Operator Salary Escalation

2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative E Capital Costs
Replacement cost for biocell fans (\$/6 fans)
Total benefits

1,901,203																					
																				6,710	
1,901,203																				6,710	

Annual Running Costs:

Labor for O&M of Fans
Electrical Cost for Biocell Fans
Total running costs

6,759	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
2,003	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127	1,127
8,763	3,615	3,664	3,714	3,765	3,816	3,869	3,923	3,977	4,033	4,090	4,148	4,208	4,268	4,330	4,392	4,456	4,522	4,588	4,656	4,725

Net Benefit/(cost)

(1,909,966)	(3,615)	(3,664)	(3,714)	(3,765)	(3,816)	(3,869)	(3,923)	(3,977)	(4,033)	(4,090)	(4,148)	(4,208)	(4,268)	(4,330)	(4,392)	(4,456)	(4,522)	(4,588)	(11,366)	(4,725)
-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	---------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

Alternative E Capital Costs
Replacement cost for biocell fans (\$/6 fans)
Total benefits

1,901,203																					
																				9,775	
1,901,203																				9,775	

Annual Running Costs:

Labor for O&M of Fans
Electrical Cost for Biocell Fans
Total running costs

6,759	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
2,003	1,149	1,172	1,196	1,219	1,244	1,269	1,294	1,320	1,346	1,373	1,401	1,429	1,457	1,486	1,516	1,547	1,577	1,609	1,641	1,674
8,763	3,688	3,812	3,941	4,075	4,213	4,357	4,506	4,660	4,820	4,986	5,158	5,336	5,521	5,713	5,912	6,118	6,331	6,553	6,783	7,021

Net escalated benefit/(cost)

(1,910,000)	(4,000)	(4,000)	(4,000)	(4,000)	(4,000)	(4,000)	(5,000)	(5,000)	(5,000)	(5,000)	(5,000)	(5,000)	(6,000)	(6,000)	(6,000)	(6,000)	(6,000)	(7,000)	(17,000)	(7,000)
-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------	---------

Cumulative escalated benefit/(cost)

Cumulative Total

\$1,910,000	\$1,914,000	\$1,918,000	\$1,922,000	\$1,926,000	\$1,930,000	\$1,934,000	\$1,939,000	\$1,944,000	\$1,949,000	\$1,954,000	\$1,959,000	\$1,964,000	\$1,970,000	\$1,976,000	\$1,982,000	\$1,988,000	\$1,994,000	\$2,001,000	\$2,018,000	\$2,025,000
-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

Life cycle cost analysis

PVs in 2013

\$1,910,000	\$4,000	\$4,000	\$4,000	\$3,000	\$3,000	\$3,000	\$4,000	\$4,000	\$4,000	\$3,000	\$3,000	\$3,000	\$4,000	\$3,000	\$3,000	\$3,000	\$3,000	\$3,000	\$8,000	\$3,000
-------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

Cumulative PV

NPV as of 2013

\$1,910,000	\$1,914,000	\$1,918,000	\$1,922,000	\$1,925,000	\$1,928,000	\$1,931,000	\$1,935,000	\$1,939,000	\$1,943,000	\$1,946,000	\$1,949,000	\$1,952,000	\$1,956,000	\$1,959,000	\$1,962,000	\$1,965,000	\$1,968,000	\$1,971,000	\$1,979,000	\$1,982,000
1,982,000																				

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

2013	Risk adjustments (+/- percent):		**Add in hauling cost reduction
	Benefits		
	Capital costs		
2.00%	Running costs		
4.00%			

**Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative F - Dewater and Reduce Trucking**

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative F Capital Costs	4,325,262																				
Odor Control Tower Media Replacement Cost																61,080					
Centrifuge Replacement Cost			647		2,336		663		34,067		680		2,404		698		68,380		718		2,486
Conveyor Replacement Cost						6,300				6,300					6,300						6,300
Savings Due to Reduced Haul (\$/yr)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)	(511,000)
Total benefits	3,814,262	(511,000)	(510,353)	(511,000)	(508,664)	(504,700)	(510,337)	(511,000)	(476,933)	(511,000)	(504,020)	(511,000)	(508,596)	(511,000)	(510,302)	(443,620)	(442,620)	(511,000)	(510,282)	(511,000)	(502,214)

Annual Running Costs:

Labor for O&M of Conveyor	1,220	1,244	1,269	1,294	1,319	1,345	1,371	1,398	1,425	1,453	1,482	1,511	1,541	1,571	1,602	1,633	1,665	1,698	1,731	1,765	1,799
Labor for O&M of Blowers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Labor for O&M of Odor Control System	2,441	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
Electrical Cost Associated with Conveyor	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599
Electrical Cost For Building Lighting	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010
Electrical Cost for Blowers and Nutrient Pump	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Odor Control Nutrient Tower Costs	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167
Total running costs	27,376	27,470	27,566	27,663	27,763	27,864	27,968	28,073	28,181	28,290	28,402	28,516	28,632	28,751	28,871	28,994	29,120	29,248	29,379	29,512	29,647

Net Benefit/(cost)	(3,841,638)	483,530	482,787	483,337	480,901	476,836	482,369	482,927	448,752	482,710	475,618	482,484	479,964	482,249	481,430	414,626	413,500	481,752	480,903	481,488	472,567
---------------------------	--------------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Alternative F Capital Costs	4,325,262																				
Odor Control Tower Media Replacement Cost																82,206					
Centrifuge Replacement Cost			673		2,528		747		39,915		829		3,049		922		93,871		1,026		3,694
Conveyor Replacement Cost						6,956				7,680						8,479					9,361
Savings Due to Reduced Haul (\$/yr)	(511,000)	(521,220)	(531,644)	(542,277)	(553,123)	(564,185)	(575,469)	(586,978)	(598,718)	(610,692)	(622,906)	(635,364)	(648,072)	(661,033)	(674,254)	(687,739)	(701,493)	(715,523)	(729,834)	(744,431)	(759,319)
Total benefits	3,814,262	(521,220)	(530,971)	(542,277)	(550,594)	(557,230)	(574,722)	(586,978)	(558,803)	(610,692)	(614,398)	(635,364)	(645,023)	(661,033)	(673,332)	(597,054)	(607,622)	(715,523)	(728,808)	(744,431)	(746,264)

Annual Running Costs:

Labor for O&M of Conveyor	1,220	1,269	1,320	1,373	1,428	1,485	1,544	1,606	1,670	1,737	1,806	1,879	1,954	2,032	2,113	2,198	2,286	2,377	2,472	2,571	2,674
Labor for O&M of Blowers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Labor for O&M of Odor Control System	2,441	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
Electrical Cost Associated with Conveyor	599	611	623	636	649	662	675	688	702	716	731	745	760	775	791	807	823	839	856	873	890
Electrical Cost For Building Lighting	5,010	5,110	5,212	5,317	5,423	5,531	5,642	5,755	5,870	5,987	6,107	6,229	6,354	6,481	6,611	6,743	6,878	7,015	7,156	7,299	7,445
Electrical Cost for Blowers and Nutrient Pump	16,812	17,148	17,491	17,841	18,198	18,562	18,933	19,312	19,698	20,092	20,494	20,904	21,322	21,748	22,183	22,627	23,079	23,541	24,012	24,492	24,982
Odor Control Nutrient Tower Costs	167	170	174	177	181	184	188	192	196	200	204	208	212	216	220	225	229	234	239	243	248
Total running costs	27,376	28,020	28,679	29,357	30,051	30,764	31,496	32,247	33,018	33,809	34,622	35,456	36,312	37,192	38,095	39,023	39,976	40,954	41,960	42,993	44,054

Net escalated benefit/(cost)	3,842,000	(493,000)	(502,000)	(513,000)	(521,000)	(526,000)	(543,000)	(555,000)	(526,000)	(577,000)	(580,000)	(600,000)	(609,000)	(624,000)	(635,000)	(558,000)	(568,000)	(675,000)	(687,000)	(701,000)	(702,000)
-------------------------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------	------------------

Cumulative escalated benefit/(cost)

Cumulative Total	\$3,842,000	-\$493,000	-\$502,000	-\$513,000	-\$521,000	-\$526,000	-\$543,000	-\$555,000	-\$526,000	-\$577,000	-\$580,000	-\$600,000	-\$609,000	-\$624,000	-\$635,000	-\$558,000	-\$568,000	-\$675,000	-\$687,000	-\$701,000	-\$702,000
------------------	-------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

Life cycle cost analysis

PVs in 2013	\$3,842,000	-\$474,000	-\$464,000	-\$456,000	-\$445,000	-\$432,000	-\$429,000	-\$422,000	-\$384,000	-\$405,000	-\$392,000	-\$390,000	-\$380,000	-\$375,000	-\$367,000	-\$310,000	-\$303,000	-\$347,000	-\$339,000	-\$333,000	-\$320,000
--------------------	-------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

Cumulative PV NPV as of 2013	\$3,842,000	\$3,368,000	\$2,904,000	\$2,448,000	\$2,003,000	\$1,571,000	\$1,142,000	\$720,000	\$336,000	-\$69,000	-\$461,000	-\$851,000	-\$1,231,000	-\$1,606,000	-\$1,973,000	-\$2,283,000	-\$2,586,000	-\$2,933,000	-\$3,272,000	-\$3,605,000	-\$3,925,000
-------------------------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-----------	-----------	-----------	------------	------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------

ANNUAL RUNNING COSTS FOR CENTRIFUGE ARE NOT INCLUDED AS THEY ARE INCLUSIVE OF THE SAVINGS DUE TO REDUCED HAUL.

From Summary Sheet:

Year of analysis
Escalation rate
Discount rate

Risk adjustments (+/- percent):

2013	Benefits	
2.00%	Capital costs	
4.00%	Running costs	

**Add in hauling cost reduction

--

Water Environment Services
Kellogg Creek Odor Analysis
Life Cycle Alternative Cost Analysis
Alternative F(2) - Dewater and Reduce Trucking (without savings)

Operator Salary Escalation

	Year																				
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operator Salary Escalation	46.94	47.86	48.80	49.75	50.73	51.72	52.74	53.77	54.83	55.90	57.00	58.11	59.25	60.41	61.60	62.80	64.04	65.29	66.57	67.87	69.21

Expressed in 2013 dollars, unescalated -- dollars

Capital & Replacement Costs:

Alternative F Capital Costs
Odor Control Tower Media Replacement Cost
Centrifuge Replacement Cost
Conveyor Replacement Cost
Total benefits

Alternative F Capital Costs	4,325,262																				
Odor Control Tower Media Replacement Cost																61,080					
Centrifuge Replacement Cost			647		2,336		663		34,067		680		2,404		698		68,380		718		2,486
Conveyor Replacement Cost						6,300				6,300						6,300					6,300
Total benefits	4,325,262		647		2,336	6,300	663		34,067		6,980		2,404		698	67,380	68,380		718		8,786

Annual Running Costs:

Labor for O&M of Centrifuge
Labor for O&M of Conveyor
Labor for O&M of Polymer System & Tote Delivery
Labor for O&M of Blowers
Labor for O&M of Odor Control System
Electrical Cost Associated with Centrifuge
Electrical Cost Associated with Conveyor
Electrical Cost Associated with Polymer System
Electrical Cost For Building Lighting
Electrical Cost for Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Centrifuge	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325
Labor for O&M of Conveyor	1,220	1,244	1,269	1,294	1,319	1,345	1,371	1,398	1,425	1,453	1,482	1,511	1,541	1,571	1,602	1,633	1,665	1,698	1,731	1,765	1,799
Labor for O&M of Polymer System & Tote Delivery	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220	1,220
Labor for O&M of Blowers	1,127	1,149	1,171	1,194	1,218	1,241	1,266	1,291	1,316	1,342	1,368	1,395	1,422	1,450	1,478	1,507	1,537	1,567	1,598	1,629	1,661
Labor for O&M of Odor Control System	2,441	2,489	2,538	2,587	2,638	2,690	2,742	2,796	2,851	2,907	2,964	3,022	3,081	3,141	3,203	3,266	3,330	3,395	3,462	3,529	3,599
Electrical Cost Associated with Centrifuge	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634	24,634
Electrical Cost Associated with Conveyor	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599	599
Electrical Cost Associated with Polymer System	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Electrical Cost For Building Lighting	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010
Electrical Cost for Blowers and Nutrient Pump	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812	16,812
Odor Control Tower Nutrient Costs	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167	167
Total running costs	53,596	53,690	53,785	53,883	53,982	54,084	54,187	54,293	54,400	54,510	54,621	54,735	54,852	54,970	55,091	55,214	55,339	55,468	55,598	55,731	55,867

Net Benefit/(cost)

Net Benefit/(cost)	4,378,858	53,690	54,432	53,883	56,318	60,384	54,850	54,293	88,467	54,510	61,601	54,735	57,256	54,970	55,789	122,594	123,720	55,468	56,316	55,731	64,652
--------------------	-----------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	---------	--------	--------	--------	--------

Expressed in escalated dollars with sensitivity adjustments

Capital & Replacement Costs:

Alternative F Capital Costs
Odor Control Tower Media Replacement Cost
Centrifuge Replacement Cost
Conveyor Replacement Cost
Total benefits

Alternative F Capital Costs	4,325,262																				
Odor Control Tower Media Replacement Cost																82,206					
Centrifuge Replacement Cost			673		2,528		747		39,915		829		3,049		922		93,871		1,026		3,694
Conveyor Replacement Cost						6,956				7,680					8,479						9,361
Total benefits	4,325,262		673		2,528	6,956	747		39,915		8,509		3,049		922	90,685	93,871		1,026		13,055

Annual Running Costs:

Labor for O&M of Centrifuge
Labor for O&M of Conveyor
Labor for O&M of Polymer System & Tote Delivery
Labor for O&M of Blowers
Labor for O&M of Odor Control System
Electrical Cost Associated with Centrifuge
Electrical Cost Associated with Conveyor
Electrical Cost Associated with Polymer System
Electrical Cost For Building Lighting
Electrical Cost for Blowers and Nutrient Pump
Odor Control Tower Nutrient Costs
Total running costs

Labor for O&M of Centrifuge	325	332	338	345	352	359	366	373	381	388	396	404	412	420	429	437	446	455	464	473	483
Labor for O&M of Conveyor	1,220	1,269	1,320	1,373	1,428	1,485	1,544	1,606	1,670	1,737	1,806	1,879	1,954	2,032	2,113	2,198	2,286	2,377	2,472	2,571	2,674
Labor for O&M of Polymer System & Tote Delivery	1,220	1,245	1,270	1,295	1,321	1,347	1,374	1,402	1,430	1,459	1,488	1,517	1,548	1,579	1,610	1,643	1,675	1,709	1,743	1,778	1,814
Labor for O&M of Blowers	1,127	1,172	1,218	1,267	1,318	1,371	1,425	1,482	1,542	1,603	1,667	1,734	1,803	1,876	1,951	2,029	2,110	2,194	2,282	2,373	2,468
Labor for O&M of Odor Control System	2,441	2,538	2,640	2,746	2,855	2,970	3,088	3,212	3,340	3,474	3,613	3,757	3,908	4,064	4,226	4,395	4,571	4,754	4,944	5,142	5,347
Electrical Cost Associated with Centrifuge	24,634	25,127	25,629	26,142	26,665	27,198	27,742	28,297	28,863	29,440	30,029	30,629	31,242	31,867	32,504	33,154	33,817	34,494	35,183	35,887	36,605
Electrical Cost Associated with Conveyor	599	611	623	636	649	662	675	688	702	716	731	745	760	775	791	807	823	839	856	873	890
Electrical Cost Associated with Polymer System	40	41	42	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Electrical Cost For Building Lighting	5,010	5,110	5,212	5,317	5,423	5,531	5,642	5,755	5,870	5,987	6,107	6,229	6,354	6,481	6,611	6,743	6,878	7,015	7,156	7,299	7,445
Electrical Cost for Blowers and Nutrient Pump	16,812	17,148	17,491	17,841	18,198	18,562	18,933	19,312	19,698	20,092	20,494	20,904	21,322	21,748	22,183	22,627	23,079	23,541	24,012	24,492	24,982
Odor Control Tower Nutrient Costs	167	170	174	177	181	184	188	192	196	200	204	208	212	216	220	225	229	234	239	243	248
Total running costs	53,596	54,763	55,958	57,181	58,432	59,713	61,024	62,365	63,738	65,144	66,583	68,057	69,565	71,110	72,691	74,311	75,969	77,668	79,408	81,190	83,015

Net escalated benefit/(cost)

Net escalated benefit/(cost)	4,379,000	55,000	57,000	57,000	61,000	67,000	62,000	62,000	104,000	65,000	75,000	68,000	73,000	71,000	74,000	165,000	170,000	78,000	80,000	81,000	96,000
------------------------------	-----------	--------	--------	--------	--------	--------	--------	--------	---------	--------	--------	--------	--------	--------	--------	---------	---------	--------	--------	--------	--------

Cumulative escalated benefit/(cost)

Cumulative Total

Cumulative Total	\$4,379,000	\$55,000	\$57,000	\$57,000	\$61,000	\$67,000	\$62,000	\$62,000	\$104,000	\$65,000	\$75,000	\$68,000	\$73,000	\$71,000	\$74,000	\$165,000	\$170,000	\$78,000	\$80,000	\$81,000	\$96,000
------------------	-------------	----------	----------	----------	----------	----------	----------	----------	-----------	----------	----------	----------	----------	----------	----------	-----------	-----------	----------	----------	----------	----------

Life cycle cost analysis

PVs in 2013

PVs in 2013	\$4,379,000	\$53,000	\$53,000	\$51,000	\$52,000	\$55,000	\$49,000	\$47,000	\$76,000	\$46,000	\$51,000	\$44,000	\$46,000	\$43,000	\$43,000	\$92,000	\$91,000	\$40,000	\$39,000	\$38,000	\$44,000
-------------	-------------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------

Cumulative PV

NPV as of 2013

Cumulative PV	\$4,379,000	\$4,432,000	\$4,485,000	\$4,536,000	\$4,588,000	\$4,643,000	\$4,692,000	\$4,739,000	\$4,815,000	\$4,861,000	\$4,912,000	\$4,956,000	\$5,002,000	\$5,045,000	\$5,088,000	\$5,180,000	\$5,271,000	\$5,311,000	\$5,350,000	\$5,388,000	\$5,432,000
NPV as of 2013	5,432,000																				